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EPOCH-MAKING BOOKS IN BRITISH SURGERY.

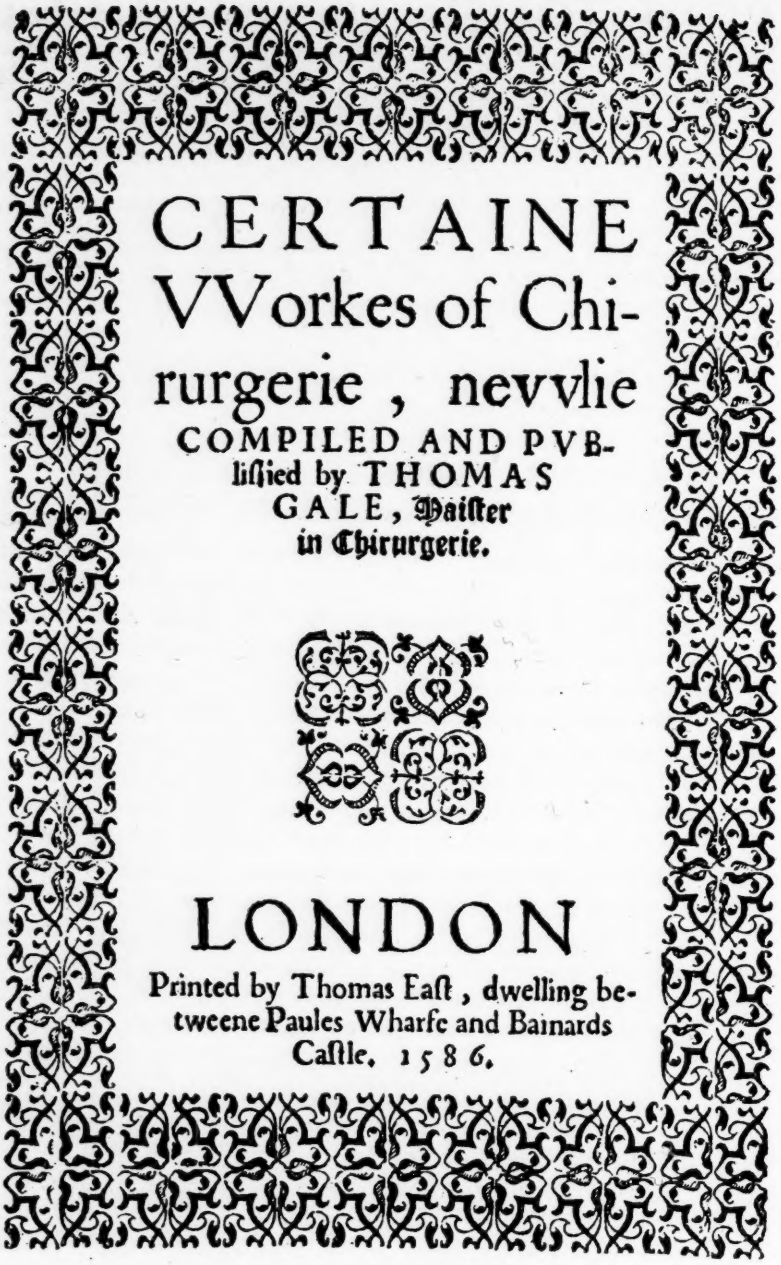
BY SIR D'ARCY POWER, K.B.E., LONDON.

II. CERTAIN WORKS OF CHIRURGERIE BY THOMAS GALE, MAISTER IN CHIRURGERIE.

THE fifteenth century in England was so distracted by wars and rumours of wars that the works of John Arderne, Gui de Chauliac, and John of Vigo had to suffice for the instruction of surgeons. Who could sit down in London to write a text-book when the watch of ten thousand men, often with the Mayor himself at the head, was parading the streets nightly to ensure the peace of the City? Surgeons did not begin to write about their art until the sixteenth century was well advanced, and then, as if they were taking stock of surgical knowledge, they went back to the old manuscript sources, and there came into existence such a book as Vicary's *Englishman's Treasure*. Nearly twenty years later—that is to say, in 1563—Thomas Gale published his Surgery in three parts: first *The Institution of a Surgeon*, then his *Enchiridion* or Manual of Surgery, and finally his *Treatise on Gunshot* and *The Office of a Surgeon*.

Of these, *The Institution of a Surgeon* is the most interesting. It is thrown into the form of a catechism, a method which had been used in teaching midwives as far back as Moschion, who lived about the year 580 A.D. The speakers are John Yates, who was an examiner in the Barber-Surgeons' Company in 1570; Maister Thomas Gale himself, who had been Master of the Company in 1561; and John Field, Master of the Company in 1577, who had been the servant and friend of Richard Ferris, a surgeon held in the highest respect by his fellows, but of whom little is now known, for he does not appear to have written anything. Yates, Gale, and Field were all well-known surgeons, therefore, Gale being the eldest.

John Yates begins the dialogue in the true spirit of Elizabethan times: "Phœbus who chaseth away the dark and uncomfortable night casting his golden beams on my face would not suffer me to take any longer sleep but said; Awake for shame and behold the handiwork of our sister Flora, how she hath revested the earth with most beautiful colours, marvellously set in trees, plants, herbs and flowers; insomuch that the old and withered coat


CERTAINE
VVorkes of Chi-
rurgerie, nevvlie
COMPILED AND PVB-
liſhied by THOMAS
GALE, Maiſter
in Chirurgerie.

LONDON
Printed by Thomas Eaſt, dwelling be-
tweene Paules Wharfe and Bainards
Caſtle. 1586.

The title page of the 1586 edition, reproduced from a copy in the writer's possession.

of Winter is quite done away and put out of remembrance; at which words of Phœbus my heart quickened in me, and all desire of sleep was eft soon forgotten. Wherefore I am now come into this beautiful meadow to recreate myself and gather some of those pleasant herbs and flowers which here do grow. But let me see, methinks I see two men walking together and reasoning also very ernestly. I will approach nearer unto them, perchance they be of my acquaintance; surely I should know them. I am deceived if the one be not my friend M. Gale and the other Maister Field. It is so indeed, wherefore I will go and salute them. God that hath brought us together into this place make this day prosperous and fortunate unto you both.

"THO. GALE: Brother Yates, the same we wish unto you and you are welcome into our companie.

"JOHN FIELD: This fair and pleasant morning will not suffer Maister Yates to keep his bed, but leaving the city he roameth the fields to espy out some strange herbs unto him yet unknown.

"JOHN YATES: I must of force confess that you do hit the nail on the head, but since my hap is so fortunate as to meet with you both and that now in this pleasant morning I would leave off my former determined purpose and require you to enter into some talk of surgery.

"THO. GALE: Your request is honest and reasonable and therefore not to be denied.

"JOHN FIELD: We were about the like thing whenas you saluted us, wherefore renewing our first talk we will accomplish your desire."

The trio then discuss the writers on surgery, the etymology of the word, and the low state into which surgery had fallen. They agree that the operation of trephining is satisfactory, and Gale says: "In my judgement the trepan is most necessary and of an excellent invention in hurts of the head. For without it where the cranium is fractured, bruised or depressed you shall little prevail". He quotes a case in illustration when "Anno 1559 in Cambridgeshire a servant of one Mr. Wroth riding in the fields and leading a young horse in a halter tied fast about the arm of the servant, the horse being wild and not broken, starting aside, unhorsed the man and drew him by his arm about a great field so long that what with striking, what with drawing, haling and pulling, being wearied he stood still until company came and unloosed the halter, and took up the man half dead and conveyed him unto his master's house. Chirurgeons were sent for who finding the servant speechless and without remembrance of any one whom he saw departed and left him for uncurable. Mr. Wroth sent for me and I seeing him speechless and without remembrance conjectured the hinder part of the head to be hurt and smitten of the horse, which I was more certain of when feeling that part I found it soft. Wherefore I, taking off the hair, did first make incision and after that set a trepan on his head and bored the cranium through and took out the piece of bone; which done, there issued out much blood, black in colour. The next day following the servant spake and came again to his perfect remembrance and I using things in this cure as art required God restored the man in my hands to his perfect health." To this John Yates replies: "This was a worthy cure and this is a noble instrument."

Inflammation and ulcers are then spoken of, and afterwards hernia. John Yates asks: "And what judge you Epiplocele to be?" John Field answers: "I will not only speak of that but also of the other kinds of Hernia. An epiplocele is a tumour coming when the Omentum falleth into the purse of the testicles. And by the like reason Enterocele taketh its name when the intestines fall into the aforesaid place. And enteroepiplocele followeth when both Omentum and the intestines fall into the scrotum or purse of the testicles. Furthermore Bubonocele happeneth when the Peritoneum is ruptured or wounded by the flanks. Exomphalos is a tumour pertaining to the overthwart muscles of the Abdomen, which being relaxed there followeth a starting or eminence of the navel." Master Gale cuts short the discussion with the remark: "My brother Yates doth the more readily conceive the differences of these kinds of Hernia for that he hath a peculiar way of curing some of them, especially of Enterocele, wherefore we will no longer stand in uttering the differences of them."

Of fractures Thomas Gale says: "There be two kinds of fractures, a simple fracture and a compound fracture.

"JOHN YATES: What is a simple fracture?

"JOHN FIELD: A simple fracture is a solution or division of continuity made in a bone without any other affect joined with it.

"JOHN YATES: What is a compound fracture?

"JOHN FIELD: It is also a solution of unity made in the bone, having one or more affects to it connected and joined.

"JOHN YATES: How many differences be there of fractures?

"THOMAS GALE: You must note that like as there be simple and compound fractures, so in like manner there be differences of fractures both simple and compound. Wherefore let me know of which fracture you would know the difference?"

To which John Yates in assumed humility replies: "I would right gladly understand all the differences, although for want of knowledge I cannot orderly demand of you. Wherefore I pray you first to begin with the differences of simple fractures and then to the compound", which Thomas Gale does at some length.

Then comes the question of the suture and dressing of wounds, about which John Yates says: "I pray you let no time herein be lost for loth I were to depart without the knowledge of them and for that you first made mention of stitching I pray you first begin with it." Thomas Gale describes three kinds of suture, and John Field says: "the needle must be long and small, being three square, the eye hollowed in that the thread may the more easily follow." And John Yates sums up the whole matter of the discourse by saying: "I will repeat in brief words so much as I can remember". The dialogue ends by Thomas Gale inviting them to supper. "And now behold, we be come to the City. Wherefore we will now leave off talk here and you both shall this night take part of such cheer as God hath sent me, and let us recreate our spirits and be merry I pray you.

"JOHN FIELD: I thank you heartily, Sir, and I rejoice that my brother Yates hath so firm and perfect a memory. God send more such to follow Chirurgery.

"JOHN YATES: I thank you both for the great benefit I have received at your hands and God grant me to spend many days in this sort."

Gale must have been a thoroughly good fellow as well as a good surgeon, for we read that in 1562—the year before this treatise was published—there was a great (archery) shooting of the Barber-Surgeons for a great supper at their own hall and they had six drums playing, and a flute and two great flags, and as a shot was won down went one and up the other, and Master Gale and his side won the supper. His teaching was sound and was the result of experience in war. He says in his *Treatise on Gunshot*, after quoting cases where he had exercised a masterly inactivity and the patient had recovered: "These I do bring forward only for example's sake, that other Chirurgions being in the wars should not too much busy themselves or put the patient to pain and in danger in taking out the shot."

Gale's treatises are less racy than those of John Arderne. They contain, too, somewhat more theory and less personal experience; but they are full of sound common sense, and the teaching is well suited to those whose surgical knowledge was of the slightest.

SOME NOTES ON THE CLINICAL FEATURES AND THE DISTRIBUTION OF SECONDARY DEPOSITS IN BONE FOLLOWING CARCINOMA OF THE BREAST.

By D. H. PATEY,

SURGICAL REGISTRAR, MIDDLESEX HOSPITAL, LONDON.

The appearance of bony deposits secondary to carcinoma of the breast is as a rule regarded by the surgeon as an indication that the disease has passed out of his province. The patients tend to drift to infirmaries, or to special homes for inoperable malignant disease, or are attended by their family doctors at home until death supervenes. In any case, they are very often lost sight of by the surgeon unless he is connected with some such institution as the above. It was therefore thought that an account of some of these patients would prove of value.

The series here recorded consists of eighteen cases which have come under observation and treatment at the Middlesex Hospital since October, 1924. They may be accepted as representative examples of the varieties of this condition seen at the above institution, though they by no means constitute the total number of cases which have presented themselves during this period, a considerable number being lost sight of after the diagnosis has been established. For descriptive purposes, they may be subdivided into three categories: *Group A*—represented by *Cases* 1 to 10—this, for reasons to be discussed later, may be called the 'diffuse' group; *Group B*—represented by *Cases* 12 to 18—the 'localized' group; *Group C*—represented by one case only, *Case* 11—the 'mixed' group, so called because the features of both former groups are combined.

GROUP A: THE 'DIFFUSE' GROUP. CASES 1 TO 10.

The essential feature of this group is the widespread nature of the bony deposits (well shown in *Figs.* 128–137), and this can only be adequately demonstrated clinically by a complete bony X-ray examination. In the earlier cases local X-ray examinations only were made of suspected parts of the skeleton. This probably resulted in the non-appreciation of the widespread nature of the disease, for when the complete examination was made deposits were frequently found in bones where they were least expected. For example, unsuspected deposits were demonstrated skiagraphically in the scapula and humerus regions in *Cases* 4, 5, and 9, and in the pelvic bones in *Cases* 5 and 6. For this reason a whole skeleton examination is necessary where exact knowledge is required; but, as the bones below the knee and elbow are so rarely involved, they may, from motives of economy, be exempt from routine examination unless there is some special indication.

The interpretation of the radiograms requires the co-operation of a radiologist. Usually the X-ray signs are so definite that diagnosis is easy, but in the earlier stages an expert opinion is advisable. Even then it is often impossible to be dogmatic, and one can only note the presence of suspicious rarefied areas, and re-examine at a later date, and in several cases of this series it was found that the re-examination enabled a tentative diagnosis to be converted into a positive. At every opportunity X-ray findings should be checked by post-mortem examination.

Relationship to Operation.—Three cases of this series (*Cases* 5, 9, and 10) developed their bony deposits before the diagnosis of the primary breast tumour was made. *Case* 10 had been treated in two other hospitals for tuberculous disease of the spine, and *Case* 9 was diagnosed as suffering from 'back strain', and in both the primary breast tumour was not noted either by the doctor or the patient until the result of the X-ray examination caused a routine search to be made for a primary growth. There appears to be something peculiar about these growths which makes them more liable to metastasize than to form a prominent local mass. Thus, at the present time, two years after the bony deposits were discovered, the primary tumour of *Case* 9 is still in what would be an operable condition were it not for those deposits. The remaining seven cases of this group had had an operative removal of the primary growth, and in all except one the bony recurrences became manifest within the first twelve months or so following operation. This was associated with local or glandular recurrences in four cases (*Cases* 2, 3, 7, and 8), and unassociated in three cases (*Cases* 1, 4, and 6). The state of the latter patients is usually the more comfortable owing to the absence of what tends to become a foul, sloughing mass of growth, and for this reason life is often longer.

Distribution.—

Pelvis.—The pelvic bones are particularly liable to involvement. In every case of the 'diffuse' group, except *Case* 7, deposits were demonstrated in these bones. Sometimes the whole pelvis is infiltrated with growth, but often certain areas are specially affected, the two chief being (1) the region of the sacro-iliac joint, and (2) the pubic and ischial rami and the neighbourhood of the acetabulum. The latter site is often associated with involvement of the head, neck, and upper end of the corresponding femur. Pelvic bone deposits are in the majority of cases symptomless, giving no evidence of their presence until the X-ray examination. In some, suspicions may be aroused by such symptoms as gnawing pains often referred to the upper part of the thigh. In the later stages (e.g., *Case* 9) there may be a falling in of the affected side of the pelvis, as a result of which the corresponding trochanter is less prominent.

Scapula.—Deposits are not infrequently found in this bone. As in the pelvis, they tend to be 'silent' clinically, though of somewhat rarer occurrence. The cancellous tissue near the glenoid cavity appears to be the favourite site. With this is often associated growth in the upper end of the humerus.

Ribs.—The ribs were affected in this series in the more diffusely involved cases such as *Case* 5 and *Case* 9.

Spine.—The vertebral bodies are common sites for metastases, as will

be seen from the diagrams. The lumbar region is the earliest and most markedly involved. As a rule the disease affects a number of adjoining vertebræ, but in one case, *Case* 7, one vertebra only, the 3rd lumbar, was involved. This, however, would appear to be exceptional. Only a minority of cases showed signs of pressure on the cord. Thus *Cases* 3, 4, 6, 9, and 10, all of which had well-marked spinal recurrences, showed no cord symptoms. *Cases* 1, 7, and 8, on the other hand, developed pressure signs, *Cases* 1 and 8 having paraplegia with urinary retention, and *Case* 7 pressure symptoms of a temporary nature only. Some of the more diffusely involved spines, e.g., *Cases* 4 and 6, developed a generalized progressively increasing kyphosis. This made it technically difficult to define precisely the outline of the vertebræ on radiographical examination.

Femur.—Deposits were noted in the head, neck, and upper end of the femur in several instances. There is no example of spontaneous fracture as a complication in this series, possibly owing to the early recognition of the presence of growth, and the consequent avoidance of weight-bearing and other traumata. The lower end of the femur was involved in one case only, *Case* 10.

Peripheral Bones of the Lower Limb.—In no case was growth found in the bones below the knee.

Humerus.—Deposits were present in the upper end of this bone in *Cases* 4, 5, and 9. This lesser susceptibility as compared with the femur runs parallel with the same feature in the scapula as compared with the pelvic bones.

Peripheral Bones of the Upper Limb.—No growth was found below the middle of the humerus.

Skull.—The skull was not radiographically examined in a sufficient number of cases to justify any conclusions; but though clinically no case gave evidence of deposits, extensive invasion of the vault was present in *Case* 5, and a suspicious rarefied area in *Case* 6.

The present study, therefore, confirms post-mortem figures[1] in showing the comparative freedom from recurrence of the peripheral bones of the limbs. Since the present series was collected, however, one case has come to post-mortem with diffuse involvement of the tibia, but this is probably exceptional.

Prognosis.—By the time that the disease has become so widespread as to involve diffusely the skeletal structures, the ultimate prognosis is, of course, hopeless; but the condition is compatible in some instances with months or even years of fairly comfortable life. Thus, *Case* 6 is still (July, 1927) alive and comfortable, though the deposits shown in the diagram were present in September, 1925, and *Case* 9 is alive and in fair general health, though it is probable from the history that the bones have been involved since February, 1925. Death occurs from exhaustion and asthenia, coming more quickly in cases with visceral deposits and in patients with signs of pressure on the spinal cord. If these are absent, however, an early death need not necessarily be anticipated.

Treatment.—This is usually palliative only, sedatives being given for the pain, and general nursing measures instituted. Some complications, as spontaneous fracture and pressure on the spinal cord, should be anticipated, and treated by rest in bed, and a spinal jacket where necessary. Posterior

root section was done in one instance (*Case* 1), but failed to give any relief. As it is a diffuse condition, such localized therapeutic measures as surgery or radium are of little value, and on theoretical grounds, if ever the cure of these cases becomes possible, it would seem that it must be through some general therapeutic agency. In rare cases, such as *Case* 7, when the symptoms are due to a deposit in one bone, marked temporary improvement may be obtained by deep X-ray therapy. This patient had growth in the 3rd lumbar vertebra only, and before treatment was confined to bed, unable to walk, and had marked difficulty with micturition. Following a course of deep X-ray treatment by Dr. Webster, she was able to walk about the ward, and even returned home for a holiday. This was accompanied on X-ray examination by a compressed and almost obliterated 3rd lumbar vertebra. Later, however, death resulted from visceral recurrences.

GROUP B: THE 'LOCALIZED' GROUP. CASES 12 TO 18.

The essential feature of this group, in contradistinction to the previous one, is the development of a deposit in one or more of the bones adjoining the field of the primary growth, i.e., the sternum or the ribs. The whole process, therefore, remains relatively local, and is open to successful attack in the early stages by such local therapeutic agents as radium. One case, *Case* 12, is an example of a local rib recurrence, and, following the treatment of this by radium, no other lesion has occurred. The remaining six cases are intercostosternal recurrences, the main features of which, and their treatment by radium, have been described by Handley.[2] Briefly, one notes the appearance of a swelling at the junction of the ribs and sternum, usually on the same side as the primary breast tumour (*see Fig.* 139), and it may be years after operation. Thus in *Case* 15 it was seven years, and in *Case* 16 twelve years. The mass, if untreated, continues to grow, and may eventually ulcerate to form a foul discharging sore as in *Case* 15, and may also spread deeply towards the mediastinum. The first indication of this clinically, e.g., *Case* 14, is often hoarseness of voice due to pressure on and paralysis of the left recurrent laryngeal nerve. Death supervenes in the majority of cases as a result of the mediastinal spread. If treated at an early stage, however, complete disappearance of the growth may occur; or, failing this, the tendency to ulceration superficially may be abolished, allowing death to take place with less pain and discomfort from the mediastinal spread. The problem, therefore, is completely different from that of the 'diffuse' group, in that the disease, though often deeply rooted, remains relatively localized.

GROUP C: THE 'MIXED' GROUP. CASE 11.

This group consists of one case only (*Case* 11), in which the features of both preceding groups are combined. This patient, in January, 1924, was treated with buried radium for an intercostosternal recurrence, following which she remained quite well and apparently free from growth until October, 1926, when deposits in the 2nd to the 5th cervical vertebræ were demonstrated. A radiogram was taken of the pelvis at this time as a routine measure,

although no suggestive symptoms were present, and a very early growth was found in the right ilium. Now (March, 1927), six months afterwards, pain in the region of the right hip is being complained of. This case is of great interest in that, in the same patient, we have the combination of the 'localized' type of bony deposit with 'cure' following the use of a local therapeutic agent (i.e., radium), and the 'diffuse' type for which only palliative measures can be adopted.

DISCUSSION.

Since the two processes are clinically so distinct, it is probable that their pathology is equally so. The localized intercostosternal recurrence may arise theoretically in two ways: first, by direct spread from the overlying permeated lymphatic plexus; or, secondly, from the internal mammary chain of glands which have been invaded either directly or retrogradely from the supraclavicular glands. The second theory is the more probable, as it better explains the great liability to mediastinal spread.

The 'diffuse' type of bony recurrence, on the other hand, results from some diffuse method of spread, either lymphatic according to Handley, or blood-borne as concluded by Piney.[3] From the clinical nature of this investigation, no conclusions can be here offered on this pathological point. The comparative youth of some of the cases of the 'diffuse' group is rather in favour of the blood-stream agency. On the other hand, the tendency which some cases (e.g., *Cases* 3, 4, and 9) show to greater involvement of the bones on the side of the primary breast tumour would rather support the lymphatic route. But the cases are too few to justify any conclusions on this score: all that can be said is that the deposits result from some diffuse process.

CASE REPORTS.

Case 1.—H. H., age 61. Radical removal of the left breast elsewhere in 1922. Twelve months following operation, she commenced having girdle pains and difficulty in walking. Five weeks before admission to the Cancer Wing she had had division of the posterior nerve-roots without any very marked benefit.

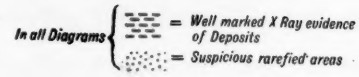
On examination in October, 1924, there was no evidence of local or glandular recurrence; complete paraplegia, with retention of urine and incontinence of fæces. Some weeks after admission thickening was noted in the region of the great trochanter of the right side. Discharged home November, 1924, rapidly going downhill.

X Rays: Local examination only made, lower dorsal region and right hip-joint, and showed: (1) Infiltration and collapse of the 9th dorsal vertebra; (2) Early deposits of growth in the region of the trochanter and neck of the right femur and the right descending ramus of the ischium. (*Fig.* 128.)

Case 2.—E. H., age 41. Radical removal of the left breast elsewhere in August, 1924. May, 1925: left-sided supraclavicular glands removed. August, 1925: the patient began to suffer from shortness of breath and cough, and stiffness of the left arm and leg.

Examination in October, 1925, showed scar recurrences, ulcerated recurrence to the left side of the upper part of the sternum, and chain of glands in the left posterior triangle.

X Rays showed (from upper dorsal spine to top part of pelvis): (1) Extensive secondary deposits in the chest; (2) Extensive deposits in both pelvic bones and the sacrum; (3) Definite deposits in the last lumbar vertebra, and ? early deposits in the upper dorsal vertebræ. (*Fig.* 129.) Discharged at own request Nov. 4, 1925.



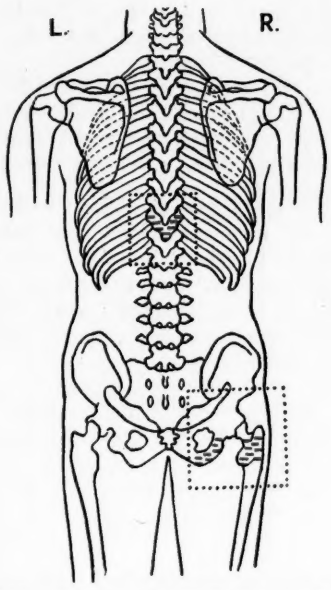


Fig. 128.—*Case* 1. Local X-ray examination within areas of dotted lines.

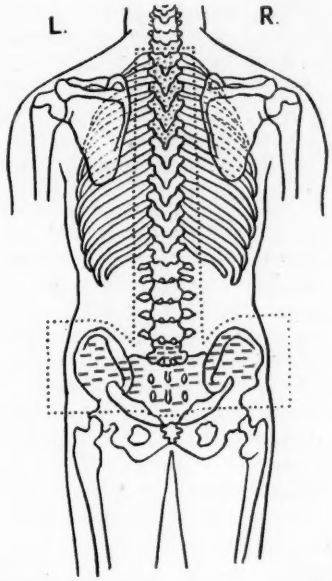


Fig. 129.—*Case* 2. X-ray examination of areas within dotted lines only.

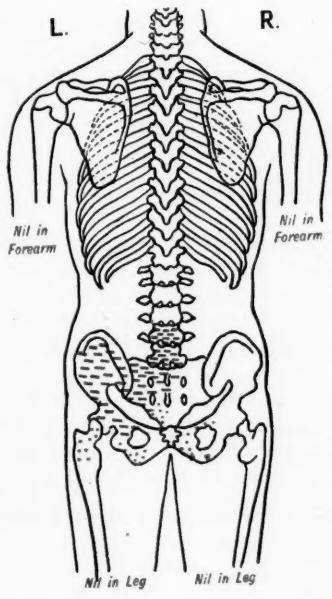


Fig. 130.—*Case* 3. Complete X-ray examination.

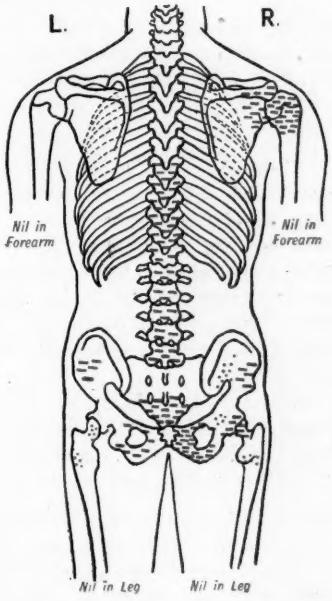


Fig. 131.—*Case* 4. Complete X-ray examination.

Case 3.—M. E., age 50. Radical removal of the left breast elsewhere in February, 1925. Recurrence in right breast, and palliative removal of this breast in June, 1925.

On examination in October, 1925, multiple nodular skin deposits were found on the chest, chiefly at the front and sides, more marked on the left side. No demonstrable glandular or visceral recurrence. Discharged at own request.

Heard of in August, 1926—still alive, but in pain.

X Rays: Complete X-ray examination made, showing: (1) No evidence of deposits in any of the peripheral bones of the limbs; (2) Deposits 4th and 5th lumbar vertebræ; (3) Deposits in sacrum and ilium in the region of the right sacro-iliac joint; (4) Suspicious area in head and neck of the right femur. (*Fig.* 130.)

Case 4.—R. G., age 41. Radical removal of the right breast elsewhere in May, 1925. Admitted to Cancer Wing Nov. 30, 1925, on account of general asthenia, and progressively increasing dorsal kyphosis, which in the first instance was stated to be an adolescent condition. Gradually went downhill, the deformity of the spine increasing, but no evidence of pressure on the cord developing; died May 20, 1926, with symptoms suggestive of intrathoracic recurrence. Patient had no evidence of local or glandular recurrence. Post-mortem refused.

X Rays: Complete X-ray examination made, showing: (1) Deposits in the lumbar vertebræ, and most of the upper dorsal vertebræ (difficult to define owing to the deformity); (2) Deposit in the 10th right rib; (3) Diffuse deposits scattered all over the pelvic bones; (4) ? Early involvement head and neck of left femur, and more definite involvement of the right femur; (5) No involvement of the bones below the middle of the humerus or the femur; (6) Deposits in right scapula and humerus region. (*Fig.* 131.)

Case 5.—E. B., age 36. Lump in right breast eight months before admission, not diagnosed as carcinoma until a gland was removed from the supraclavicular triangle at another hospital, and microscoped. Almost simultaneously with the development of the lump, had pain in the side, which was diagnosed as pleurodynia, and pain in the lower part of the back and the left leg. Admitted to Cancer Wing Aug. 24, 1926.

On admission two carcinomatous masses were found in the right breast, not attached to the skin or deeper tissues, and about 1½ in. in diameter. Glands in both axillæ and supraclavicular fossæ, more marked on the right side. Liver not palpable, and no evidence of abdominal recurrence. General condition very wasted, and ill looking. Died of asthenia Nov. 19, 1926.

X Rays: Complete bony X-ray showed: Deposits in all the bones of the body except the bones below the knee and the elbow. (*Fig.* 132.)

Case 6.—A. H., age 46. Operated upon in 1920 elsewhere—radical removal of carcinoma of the left breast.

Admitted September, 1925, with pain under the right costal margin. Simulated gall-bladder disease; cholecystogram gave negative result. On examination there was no evidence of local or glandular recurrence. General condition appeared excellent. Has continued in fair health until the present time (January, 1927), the only alteration being a gradually appearing dorsal kyphosis, which even now is only slight in degree.

X Rays: Complete bony X-ray showed: (1) Deposits in the spine from the 4th dorsal to the sacrum, being well marked in the 7th dorsal to 1st lumbar; (2) Diffuse infiltration of all pelvic bones; (3) Suspicious rarefied areas in head and neck of both femora; (4) No bony deposits below the knee or the elbow. (*Fig.* 133.)

Case 7.—E. S., age 45. November, 1924: radical removal of left breast elsewhere. September, 1925: glands in the left supraclavicular region, to which X rays were given. December, 1925: was confined to bed with pain in lumbar region and pelvis and in the thighs. Marked difficulty in micturition.

On examination local recurrence was found in scar of operation, and in the left supraclavicular fossa. Deposit in 3rd lumbar vertebra. Treated by X rays

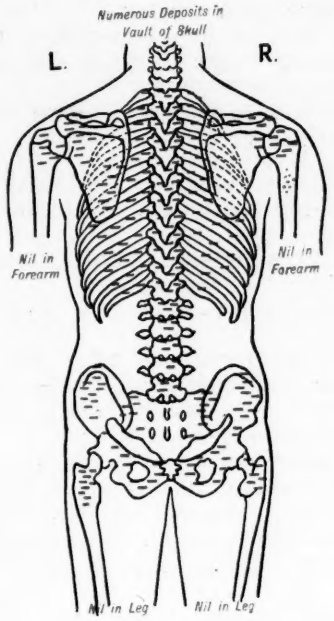


Fig. 132.—*Case* 5. Complete X-ray examination.

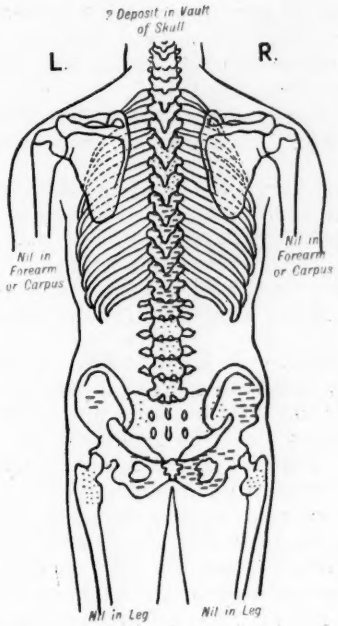


Fig. 133.—*Case* 6. Complete X-ray examination.

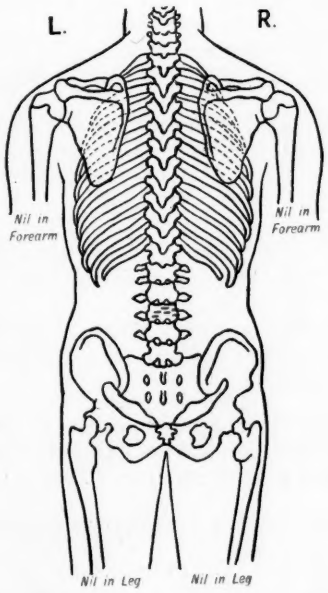


Fig. 134.—*Case* 7. Complete X-ray examination.

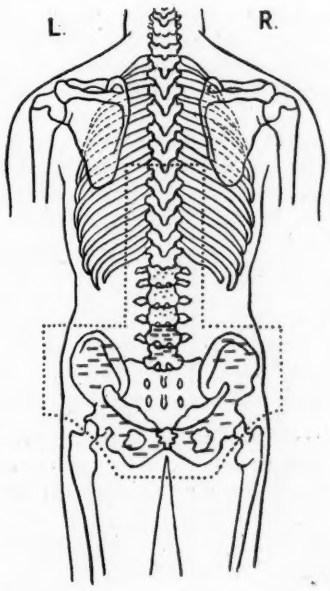


Fig. 135.—*Case* 8. Local X-ray examination only within area of dotted lines.

both locally and to the lumbar spine. Condition improved remarkably, and patient was able to get up and walk about, and went home for a holiday.

On readmission local recurrences began to increase in size rapidly, a mass developed in the left axilla, and the patient gradually went downhill and died of asthenia July 30, 1926.

X Rays: Complete examination showed deposit in the 3rd lumbar vertebra (*Fig.* 134). Post-mortem confirmed X-ray finding.

Case 8.—I. E., age 33. Radical removal of carcinoma of the left breast in this hospital in January, 1925. Had subsequent X-ray treatment. Was readmitted June, 1926, with wasting and pain in legs.

On examination, paralysis of both lower limbs, some skin nodules around the operation scar, and the liver was just palpable.

X Rays, local only: Deposits in the pelvis and the lumbar spine (*Fig.* 135).

Case 9.—K. E., age 48. Operation April, 1923, for gastric ulcer and cholecystitis. In February, 1925, complained of pain in lumbar spine and pelvis following a blow: ordered massage and electrical treatment. July, 1925: lump in the right breast first noticed. Admitted to the Cancer Wing October, 1925.

On examination a lump about 1 in. in diameter was found in the upper and outer quadrant of the right breast. Not attached to skin or deep fascia. No glands, or evidence of intrathoracic or abdominal deposits. Bones: *see Fig.* 136. Has remained much the same until the present time (July, 1927). The lump in the breast has increased a little in size and is now definitely attached to the skin, but no other palpable deposits have developed.

X Rays: Showed deposits as in the appended diagram (*Fig.* 136).

Case 10.—M. D., age 29. Admitted June 13, 1926, for pain in the left hip region and in lumbar spine. Had been treated in one hospital in November, 1925, as case of sciatica, and at another as a case of tuberculosis of the hip. It was only after the X-ray examination that a carcinoma of the breast was suspected, and a typical carcinoma of the upper and outer quadrant of the right breast was discovered.

X Rays (peripheral bones not taken): (1) Diffuse deposits were seen throughout the whole of the spine, most marked in the 8th dorsal, which was collapsed, the upper dorsal region, and the last lumbar vertebra; (2) In the pelvis and upper ends of the femora, much more marked on the left side, the head and neck of the left femur being almost destroyed; (3) In the lower end of the left femur. (*Fig.* 137.)

Case 11.—E. W., age 67. Operation for carcinoma of the left breast May, 1923, elsewhere. December, 1923: came to the Cancer Out-patient Department with intercostosternal swelling at junction of 1st and 2nd pieces of sternum. Treated in January, 1924, by buried radium.

October, 1926: complained of pain and stiffness of the neck. X rays showed deposits in the 2nd to the 5th cervical vertebræ, with collapse of the 2nd. Now in Cancer Wing fitted with a poroplastic jacket. Pain in neck relieved, and general condition very good. No evidence of sternal or other recurrence.

X Rays: (1) Deposits in the cervical vertebræ as noted above; (2) Pelvis—very early deposits in the right ilium. (*Fig.* 138.) No general X-ray examination performed. Later, died May, 1927, with liver recurrences.

Case 12.—E. E., age 54. August, 1924: operation for carcinoma of the right breast elsewhere. July, 1925: came to the Cancer Out-patient Department with a nodule fixed to the 3rd rib in the right anterior axillary line. X-ray of chest negative. No other signs of recurrence.

Treated by superficial radium, and when last seen, in January, 1927, quite well and free from recurrence.

Case 13.—K. G., age 46. In 1921, elsewhere, there had been a partial removal of the right breast for carcinoma.

Admitted in March, 1924, with intercostosternal recurrence at junction of 1st

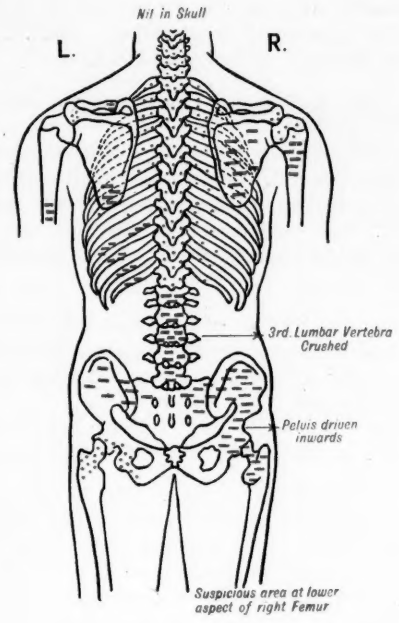


Fig. 136. — *Case* 9. Complete X-ray examination, excluding forearm and leg bones.

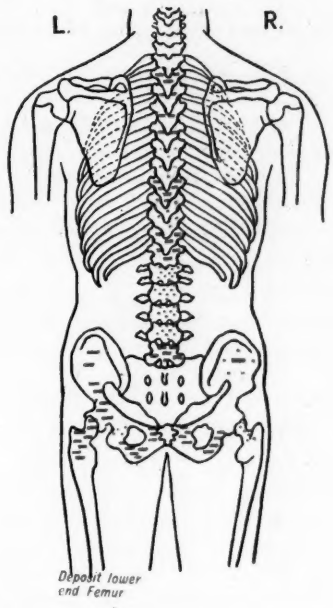


Fig. 137.—*Case* 10. Complete bony X-ray examination, excluding forearm and leg bones.

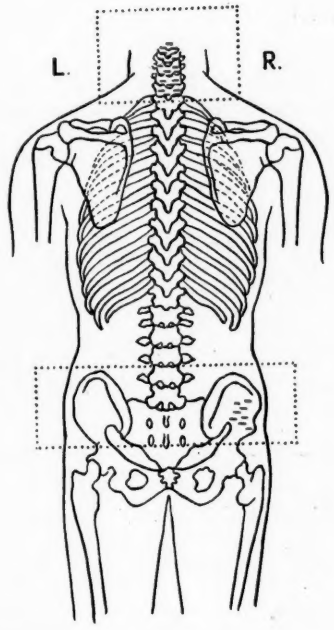


Fig. 138.—*Case* 11. Local X-ray examination, within area of dotted lines.

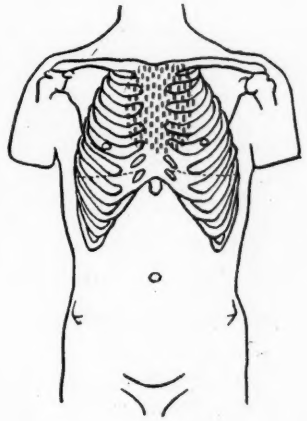


Fig. 139.—Showing the area within which the intercostosternal recurrences occur, usually on the same side as the primary breast tumour (cf. *Cases* 12–18).

and 2nd costal cartilages with the sternum. Treated by buried radium by the encirclement method. Mass totally disappeared, but in November, 1924, a further treatment with radium was carried out owing to a small recurrence. Died at home with symptoms suggestive of mediastinal recurrence February, 1925.

Case 14.—M. A., age 77. Removal of the left breast elsewhere for carcinoma in 1921.

May, 1924 : intercostosternal recurrence left side, in region of 2nd costal cartilage and 1st intercostal space. Recurrence disappeared. Remained quite well until April, 1925, when hoarseness of voice due to a paralysis of the left recurrent laryngeal nerve developed. Died in February, 1926, and post-mortem showed growth in anterior mediastinum spreading to the roots of the lungs, and in the supraclavicular triangles.

Case 15.—K. M., age 57. Operation for carcinoma of the left breast in 1917.

Readmitted November, 1924, for ulcerated sternal recurrence on the left side at the junction of the 2nd costal cartilage and 2nd intercostal space with the sternum. Treated on two occasions with buried radium, and mass disappeared.

Last heard of in November, 1925, when she had difficulty in breathing and cough, suggesting the presence of mediastinal secondaries. Presumed dead.

Case 16.—M. S., age 66. Removal of left breast for carcinoma in 1912 elsewhere,

November, 1924 : intercostosternal recurrence at the junction of the 2nd costal cartilage and 2nd intercostal space with the sternum on the left side. Treated on two occasions with buried radium by the encirclement method, and lump disappeared. Mass did not recur, but later symptoms of mediastinal deposits appeared, and when last heard of, in June, 1926, patient appeared to be dying from this cause.

Case 17.—A. K., age 66. Left breast removed for carcinoma in 1907 elsewhere. At the beginning of 1926 a swelling was noticed at upper part of sternum, and left supraclavicular fossa.

On admission, November, 1926, there was an elevated intercostosternal recurrence at the junction of the 1st left costal cartilage with the sternum, and two hard supraclavicular glandular nodules. Treated by buried radium. Too early to determine end-results.

Case 18.—E. G., age 63. Removal of left breast by Mr. Handley in 1908 at the Bolingbroke Hospital. Treated in 1918 by buried radium for intercostosternal recurrence in the region of 3rd and 4th costal cartilage.

Remained quite well until 1926, when mass reappeared for which X-ray treatment was ordered, since which the swelling has become smaller.

I have much pleasure in acknowledging my indebtedness to the surgeons of the Middlesex Hospital for permission to use cases, to Dr. Douglas Webster for helpful criticism and use of material, to Dr. Nicholas for much help in the interpretation of the radiograms, and especially to Mr. Sampson Handley, under whose care were most of the patients, for permission to use cases, and for constant help and guidance in the preparation of the paper.

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NEW OPERATION ON DROP-FOOT.

By C. LAMBRINUDI,

REGISTRAR, ORTHOPÆDIC DEPARTMENT, GUY'S HOSPITAL, LONDON.

THOUGH successful operations have been devised for almost every deformity of the foot, an entirely satisfactory one for the relief of drop-foot has not yet been found.

Tenodesis is unsatisfactory because the tendon invariably stretches. Astragalectomy with backward displacement of the foot, though excellent for a flail-foot, is not successful where the gastrocnemius is active, because the backward displacement lengthens the lever, and thereby increases the power of the muscle whose over-action it is desired to correct. The same applies to Dunn's operation. Arthrodesis of the ankle-joint is useful in some cases; but, since a large number of paralytic drop-feet are also associated with unstable subastragaloid joints and consequent valgus or varus deformity, arthrodesis of this joint is also required. This double arthrodesis produces an extremely rigid and uncomfortable foot, and on the whole is not recommended by orthopædic surgeons.

A year ago, at the Meeting of the British Orthopædic Association at Manchester, Ollerenshaw showed cases of the bone-block operation originally recommended by Campbell in America. This consists in excising the scaphoid, displacing the foot backwards, arthrodesing the subastragaloid joint, and making a pillar of bone with a graft at the back of the os calcis. The foot is stable and the patient walks very well; but, looking at the skiagrams in Campbell's original paper in the *Journal of Bone and Joint Surgery*, I am impressed by the fact that the graft looks extremely attenuated and atrophic. That this graft should undergo a pressure atrophy seems a reasonable thing to expect. I cannot think of any joint where two bones coming together, as a natural mechanism of locking, are not covered by articular cartilage. If the constant pressure of an aneurysm will erode the sides of the bodies of the vertebræ, it seems likely that the constant pressure of the tibia will do the same to the small graft. Indeed, Ollerenshaw reported that in two or more of his cases the graft had fractured.

Principle of the New Operation.—The normal locking of the ankle-joint in full equinus is produced by the posterior tubercle of the astragulus coming in contact with the posterior margin of the articular surface of the tibia, both covered by cartilage. This is a natural bone-block, and more effective than any bone-graft possibly could be. Consequently, if the ankle-joint remained locked in full equinus, and the correction were made for the deformity at the joint below, the foot could not drop any further. The idea originally occurred to me after experiencing great difficulty in correcting a paralytic equinus of long standing. Eventually, after having recourse to open division of the posterior ligaments of the ankle-joint, I succeeded; but, in order to

maintain my correction, the patient was obliged to wear steel supports and a toe-raising spring. In other words, I had converted a stable condition into an unstable one. It would have been wiser had I allowed the ankle-joint to remain fixed as it was, and made the correction at the subastragaloid joint. With this object in view, the following operation has been devised.

Description of the Operation.—A J-shaped incision is made, starting 4 in. above the external malleolus, close to the posterior margin of the fibula, carried down below the external malleolus, and ending at the centre of the

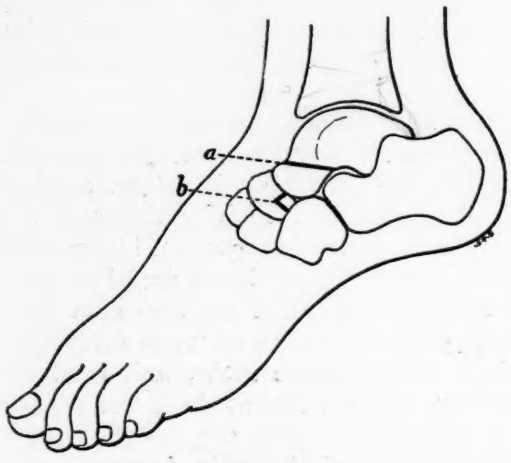

FIG. 140.—Showing the portions of bone removed: *a*, From the astragalus; *b*, From the scaphoid.

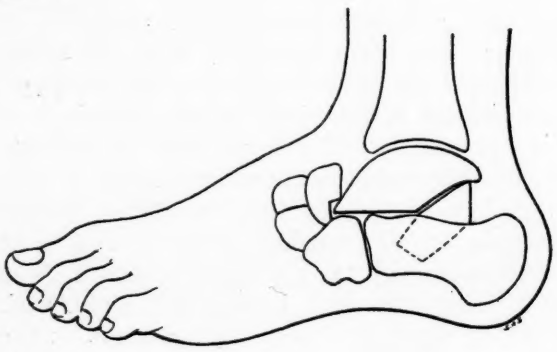

FIG. 141.—Position of the bones after operation.

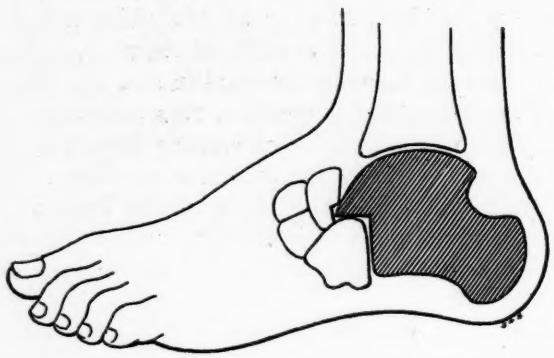

FIG. 142.—Final condition after fusion.

middle metatarsal bone. The skin, together with all the soft parts right down to periosteum, is dissected back *en masse* so as to expose the front and back of the ankle, great care being taken to leave intact the anterior and posterior ligaments of the ankle-joint itself. The peronei are divided low down and dissected up. The astragalo-scaphoid joint is next sought for, opened, and the knife is carried under the head and neck of the astragalus into the front part of the subastragaloid joint. The interosseous ligament is then divided, and the knife carried into the posterior compartment of that joint.

The subastragaloid joint is now sufficiently freed to allow the foot to be dislocated inwards, leaving the astragalus *in situ*. In order to mobilize the foot a little more, the soft parts are dissected away from the inner side of the astragalus. The cartilage is then removed from the upper surface of the os calcis and the lower articular surface of the astragalus, and a notch is made horizontally from side to side in the postero-inferior aspect of the scaphoid (*Fig.* 140, *b*). Then the head of the astragalus is depressed to its utmost limit, and the neck is sawn through in the direction of the black line *a* as shown in *Fig.* 140. The foot is next dorsiflexed, so that the cut surface of the neck of the astragalus lies on the upper surface of the os calcis, and the sharp anterior margin fits into the notch made in the scaphoid. The obliquity of the sawcut through the neck of the astragalus depends upon the angle at

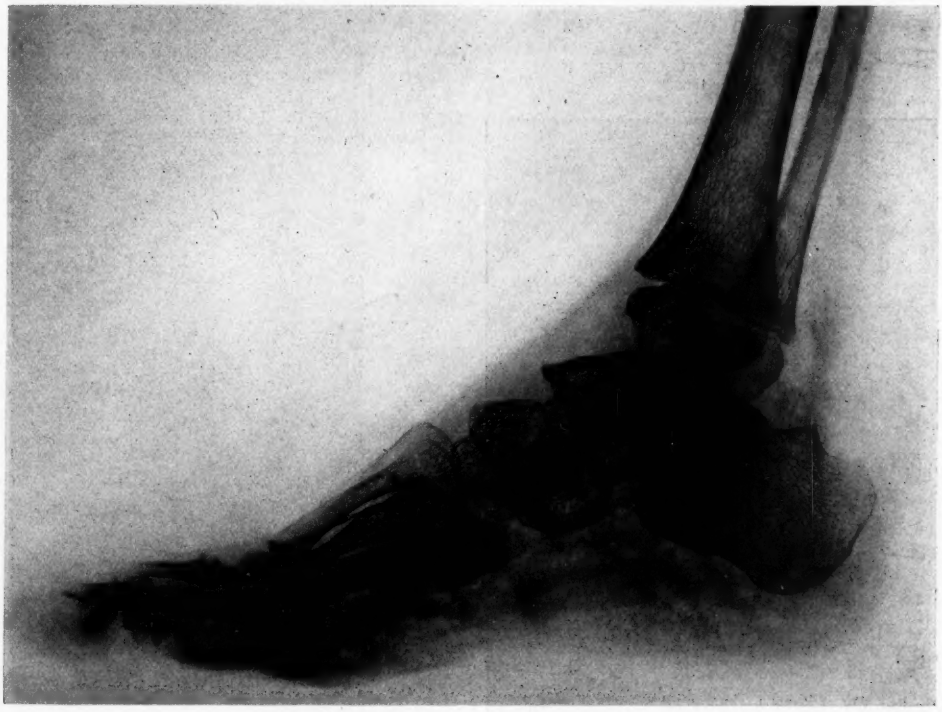

FIG. 143.—Case that failed. Showing the cut surface of the neck of the astragalus pointing forwards instead of downwards.

which it is desired to set the foot. If the paralysis is complete, the foot should be set at an angle of 95° to the leg; if it is incomplete, it should be set in varying degrees of equinus, so that whatever power remains can be employed over a more useful range.

The angle produced between the articular surfaces of the os calcis and the astragalus, both denuded of their cartilage, is now filled up by a graft taken from the excised head and neck of the astragalus. This graft is not intended to act either as an intra- or extra-articular block, but is designed merely to increase the antero-posterior thickness of the astragalus when placed in this practically vertical position.

Fig. 141 shows the position of the bones as they should be after the operation, and *Fig.* 142 the ultimate shape which the astragalus, os calcis, and graft are expected to assume when complete fusion has occurred. The foot is set at an angle of 95° to the leg, and cannot drop, because the ankle, joint is locked in full equinus.

Type of Foot Suitable for Operation.—The first essential is that there should be good power in the gastrocnemius muscle. For reasons that have already been mentioned, other methods do not succeed where this muscle is active. This operation has been tried for almost all degrees of drop-foot, from complete paralysis of the dorsiflexors to partial paralysis associated with a valgus or varus deformity. If the deformity of the foot is marked, particularly if there is any fixed metatarsus varus, it is best to correct it by a preliminary operation or manipulation as the case may be. I have performed it 9 times,

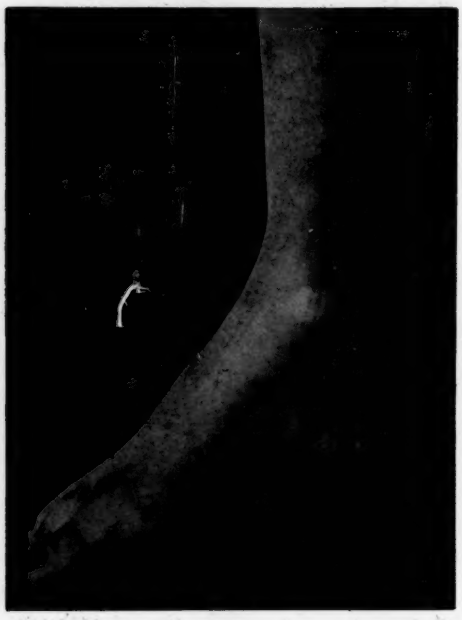

FIG. 144.—W. W., age 8. Case of partial foot-drop. Photograph four months after operation.

FIG. 145.—An antero-posterior view of the same case as *Fig.* 144.

between the ages of six and sixteen; it has been completely satisfactory in 7 and failed in 2. These two failures were due to slipping of the astragalus as can be seen in *Fig.* 143. The best functional result is obtained in cases of partial paralysis, because it is then possible to place the foot at an angle which enables the patient to make better use of what power he has left (*Figs.* 144–146). In one case I transplanted the active peronei into the tibialis anticus and peroneus tertius, and set the foot at an angle of 100°, with a very good result (*Figs.* 147–149). Whether the paralysis is complete

or not, it is best not to set the foot at right angles to the leg, because it makes the wearing of an ordinary heel uncomfortable, and prevents the active gastrocnemius from coming into action when walking. If the foot is

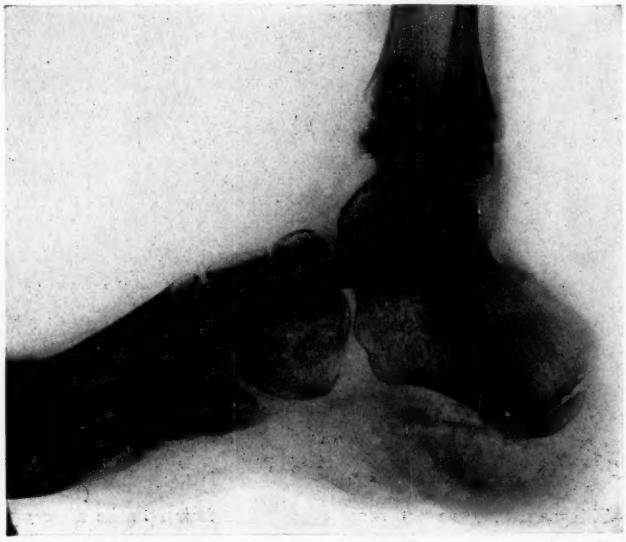

FIG. 146.—Skiagram of same case as *Fig.* 144 four months after operation.

set at 95° there is a range of passive dorsiflexion from 95° to 85°, and the gastrocnemius acting through even this small range gives some spring to the gait.

FIG. 147.—A. S., age 8. Case of complete paralysed dorsiflexors, but active peronei. These were transplanted anteriorly. Photograph shows range of plantar flexion.

FIG. 148.—Same case as *Fig.* 147. Showing active dorsiflexion by the transplanted peronei.

Prognosis.—The two important considerations are: (1) Is there any tendency to dropping? (2) Is there a likelihood of a mechanical arthritis

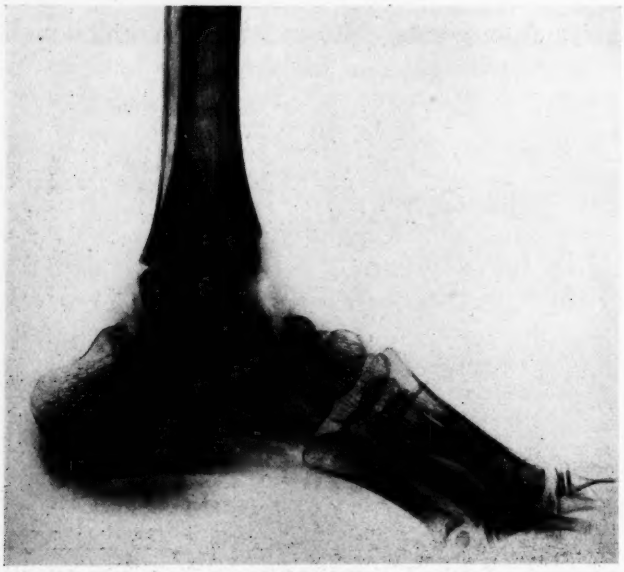

FIG. 149.—Skiagram of the same case as *Fig.* 147 four months after operation.

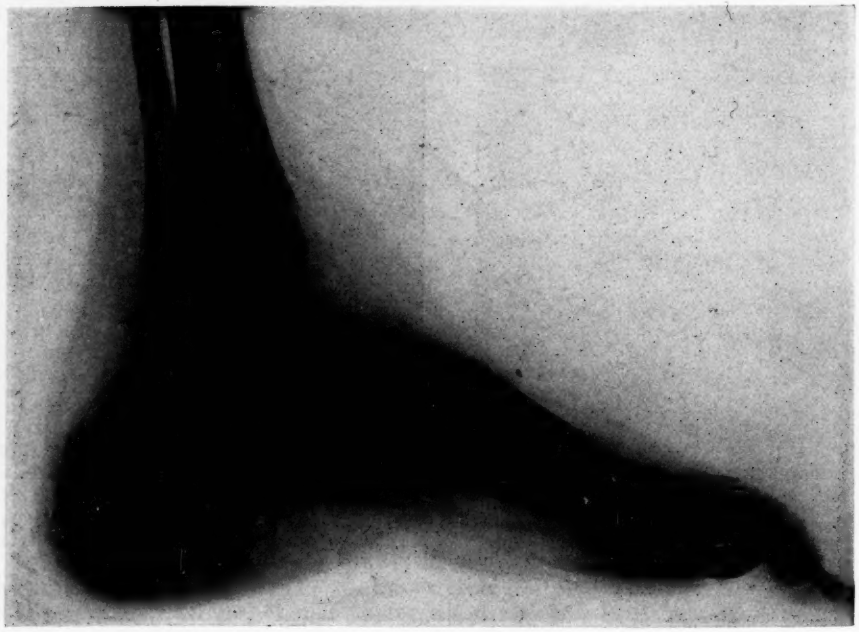

FIG. 150.—S. P., age 12. Case of complete foot-drop with some action in the tendo Achillis. Walk with high-stepping gait. Skiagram taken immediately after operation.

at the ankle-joint? Time alone can give a final answer to these questions. The first operation of this kind was performed at the Balaam Street Hospital for Crippled Children, Plaistow, fifteen months ago (*Figs.* 150–152). It has withstood the test of that time extremely well; the patient walks in an ordinary boot, without a limp, and has no pain. In comparing *Fig.* 150

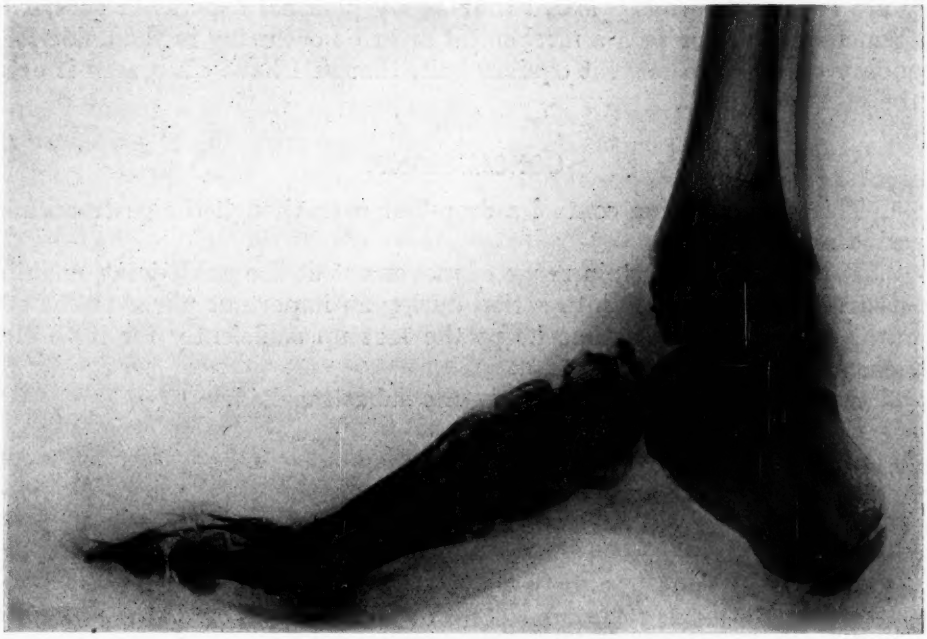

FIG. 151.—Skiagram of the same case as *Fig.* 150 eleven months after operation.

FIG. 152.—Photograph of same case as *Fig.* 150 fifteen months after operation.

and *Fig.* 151 a tendency to drop at the midtarsal joint can be seen. It is, however, slight, and has not increased during the last six months. In order to overcome this tendency, I have modified the later operations and notched the scaphoid. This gives more security to the fore-foot without stiffening it too much. In none of the other cases has this tendency been noticed. In my opinion every effort should be made to avoid arthrodesing the midtarsal

joint. Even should a slight hypermobility occur at this joint, it is no disability; it can be controlled by wearing a boot instead of a shoe, and is more comfortable than a rigid foot.

With regard to the second question, the mechanical conditions at the ankle-joint are not such as would suggest a liability to the development of an arthritis. The relationship of the bones is normal; the method whereby they are locked is normal; and, so far as my personal experience goes, I do not remember to have seen a mechanical arthritis occurring in the ankle-joint secondary only to a persistent equinus gait, though I have often seen it occur at the midtarsal joint.

CONCLUSIONS.

1. This operation can control a drop-foot even though the gastrocnemius is active and powerful.

2. It permits of a certain range of movement at the ankle-joint, enabling the gastrocnemius to come into action during an important phase of the step forward, and at the same time keeps the foot up sufficiently for it to clear the ground.

3. Only one joint is arthrodesed—the subastragaloid.

FRACTURES OF THE UPPER END OF THE FEMUR.

By GEORGE F. STEBBING,

ASSISTANT MEDICAL OFFICER, LAMBETH INFIRMARY, LONDON.

Since Sir Astley Cooper first wrote his classical account of these injuries at the beginning of the nineteenth century, so much has been written and said on the subject that perhaps an apology might be thought needed for discussing the subject once again. The reason is to be found in the fact that the description of them in the most recent text-books of surgery is untrue of the injuries as we see them in practice, the same errors being repeated again and again and many gross assumptions being accepted as true although there has never been any evidence produced to justify their acceptance.

The observations in this paper are based on the experience of 341 cases of fractures of the upper end of the femur which have been under the care of my colleagues and myself at Lambeth Hospital since 1912, and it is not necessary, therefore, to attempt to summarize the vast literature of the subject. As I am anxious, however, to point out and emphasize the common misconceptions, I must briefly refer to accounts of these injuries that are given in recent text-books, and it is instructive to compare them with Sir Astley Cooper's description of a hundred years ago. For it is a noteworthy fact that the erroneous statements that are commonly made to-day are repetitions of those made by Sir Astley Cooper, although a careful reading of his treatise shows that the general deductions that he made are not borne out by the cases which he describes so fully and from which he made them.

Sir Astley Cooper divides fractures of the upper end of the femur into: (1) Intracapsular fractures, which occur in elderly people between 50 and 80; (2) Extracapsular fractures at the junction of the neck and great trochanter, which occur in young people; (3) Fractures through the great trochanter, which occur at every period of life. While such is his general description, the cases that he describes include an intracapsular fracture in a woman of 38; three cases of extracapsular fracture (the only three he mentions) at ages of 83, 68, and 60; and cases of fracture through the great trochanter in "a middle-aged man", a patient of 46, and a girl of 16, the latter being a patient who, he says, was suffering from "constitutional symptoms evidently more violent than usually arise from fractured femur", and at whose post-mortem, nine days after the injury, the hip-joint was found to be full of pus.

The recent text-books I have read vary slightly in their description of these injuries, but all more or less correspond to Kocher's division of them into five varieties: (1) Subcapital fractures; (2) Fractures of the neck proper; (3) Fractures along the anterior intertrochanteric line; (4) Fractures of the great trochanter; (5) Subtrochanteric fractures. The terms intracapsular and extracapsular are used, but most of the books point out that the terms are misleading. They all agree in saying that fractures of the neck occur as a

result of indirect violence, most commonly in elderly people, and in women more than men, and attribute their greater frequency in women to the fact that the neck of the femur in women joins the shaft at a greater angle than it does in men. They also all agree in saying that fractures through the outer part of the neck and through the great trochanter are the result of direct violence caused by falls or blows upon the great trochanter, and occur most often in young or middle-aged men.

In describing the signs of the injuries the text-books agree in saying that in fractures of the neck there is less shortening than in those through the great trochanter, wherein they differ from Sir Astley Cooper, who emphasizes the point that in 'intracapsular' fractures the shortening is 1 to 2 in., while in 'extracapsular' fractures there is little, if any, shortening.

In describing the results of these injuries, all the accounts agree that bony union of the fragments seldom or never occurs in fractures through the neck, and practically always is found in fractures through the great trochanter. Many ingenious theories are suggested to account for the failure of bony union in the former variety; but, as I shall have occasion to point out when discussing treatment, there is no reason to believe that the factors influencing union in these fractures are different from those with which we have to deal in fractures of any part of any long bone.

In the series of fractures with which this paper is concerned there are 341 fractures of the upper end of the femur. This figure excludes separation of the upper epiphysis of the femur in children, of which I have seen very few; avulsion fractures of the great trochanter and similar fractures of the lesser trochanter, both of which occur but would require separate consideration; and fractures due to neoplasms of the femur, which frequently involve the head and neck of the femur, but are outside the scope of this paper.

A consideration of the 341 fractures shows them to represent three, and only three, types of injury, differing from one another in the situation of the fracture, in the mechanisms that produce them, in the treatment that is needed for them, and in the results that may be expected from them.

1. **Fracture through the Neck of the Femur** (*Figs.* 153, 154).—In this type the fracture is purely one of the neck of the femur, and in the great majority of the cases the line of fracture runs transversely across the neck at its narrowest point. In a few cases the fracture is nearer to the head; it is never near the great trochanter, and there is seldom any comminution. The amount of displacement of the fragments varies greatly; in a few the fracture is little more than a crack, but in most of them there is a considerable elevation and rotation outwards of the lower fragment. The rotation outwards gives rise to a radiographic appearance of shortening of the neck, and has often led to the erroneous idea that the neck has been absorbed. The shortening of the limb produced by such a fracture as that shown in *Fig.* 153 is at least 1½ to 2 in., and sometimes more, and it may be seen that the upper edge of the great trochanter is above the upper edge of the acetabulum.

This type of fracture is, I believe, always produced in the same way, and no better description of the way in which it is produced can be found than that given by Sir Astley Cooper, who says: "I was informed by a person who had sustained a fracture of this kind, that being at her counter and suddenly

turning to a drawer behind her, some projection in the floor caught her foot, and preventing its turning with the body, the neck of the thigh bone became fractured ". In some cases, such as those in which the foot slips off the kerb, it is the lower limb that is forcibly twisted outwards, the pelvis being held still. In each case the force producing the injury is an axial torsion of the lower limb, and the bone breaks at its weakest point—that is, the neck of the femur. It is easy to understand that the precise direction and position of the fracture may be influenced by the degree of abduction or adduction of the limb at the time of the twist, but the break will always be confined to that part of the femur that is running more or less horizontally inwards.

FIG. 153.—Fracture through the neck of the femur. A typical example.

FIG. 154.—Shows a similar fracture to *Fig* 153, with the broken neck in profile riding high above the head of the bone.

2. **Fractures through the Great Trochanter.**—*Fig.* 155 may be taken as a type of this fracture, but the anatomical arrangement of the lines of fracture in this class vary much more than they do in fractures of the neck. They all, however, have in common the characteristics that the fracture involves the great trochanter; that there is more or less comminution; that the angle which the neck makes with the shaft is decreased, generally to a right angle or less; and that there is considerable external rotation of the lower fragment, as may be seen by the profile view of the lesser trochanter.

This fracture is, I believe, always caused in the same manner, and here again I find the best description in Sir Astley Cooper's treatise, in spite of his views on the causation of this injury. In reporting his first case he says in his quaint way: " Mary Clements, æt. 83½, when walking across her room, October 1st, 1820, supported by a stick, which from the debility consequent

upon old age, she was obliged to employ, unperceived by herself, placed the stick in a hole in the floor, by which her balance was lost; and tottering to recover herself from falling—which she would have done but for those near her [please note those words]—she found she had as she supposed dislocated her thigh bone". He goes on to say that she had an extracapsular fracture. In this case there was no question of a direct fall on the great trochanter; he expressly says she did not fall, and I do not believe that any fracture through the great trochanter can be caused by a blow directly on that bone. *Fig.* 156 shows what happens if a direct blow is given to the great trochanter with breaking force—the femur remains intact and the pelvis breaks at the acetabulum; if the force is greater, the head of the bone is driven through the acetabulum into the pelvis. There have been three such injuries in Lambeth Hospital during the time covered by this series, and they are not included in the 341 cases with which this paper deals.

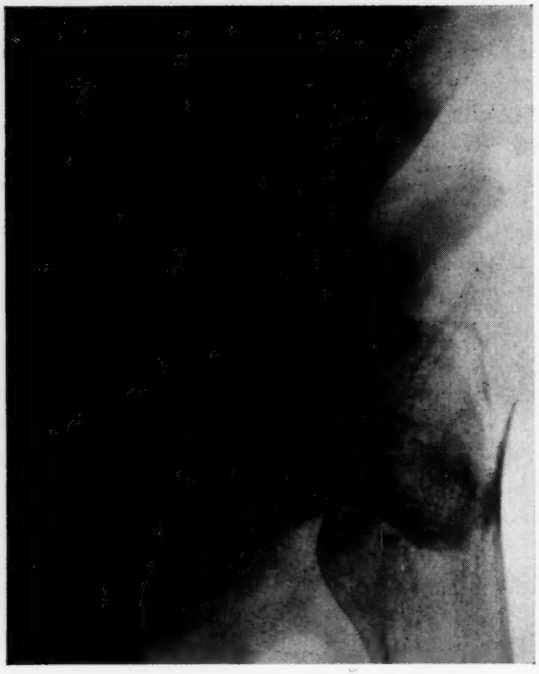

FIG. 155.—Fracture through the great trochanter.

Fractures through the great trochanter are caused when a patient slips and the weight of the body is forcibly thrust on to the head of the femur when

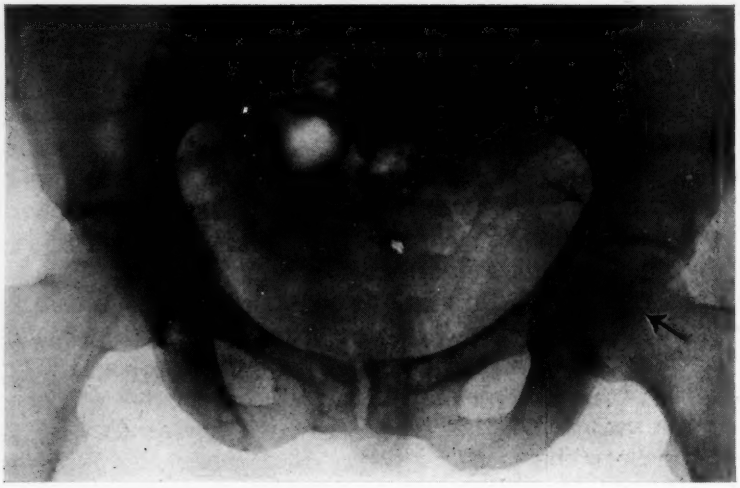

FIG. 156.—Fracture of the pelvis at the acetabulum caused by a direct blow on the great trochanter, but no fracture of the trochanter.

the limb is more or less adducted and slightly rotated outwards. The bone then breaks at the point where the shaft joins the head, and, because the bone there is largely cancellous, comminution occurs, the bone splintering in various directions. *Fig.* 157 shows a case in which such a fracture occurred but was incomplete, and the fracture may be seen where the neck has bent on the shaft but stopped before the major injury has occurred. It would be impossible to conceive of such an injury being produced by a fall on the great trochanter.

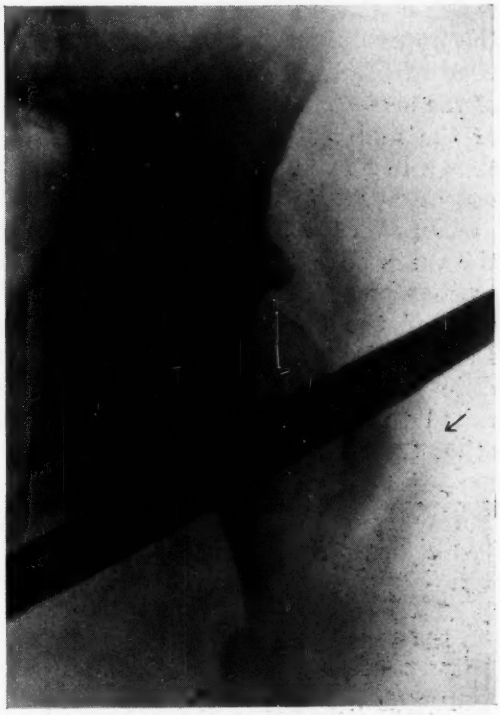

FIG. 157.—Incomplete fracture through the great trochanter.

Because the fracture occurs when the limb is adducted, the patient generally falls on to the injured side, and this fact has probably given rise to and perpetuated the erroneous view that direct violence causes this type of fracture. If additional evidence be needed that the breaking force is transmitted from the foot, it may be found in the fact that most patients with fractures of this type have traumatic synovitis of the knee-joint on the same side, a point that is often missed and to which I shall refer when writing of treatment.

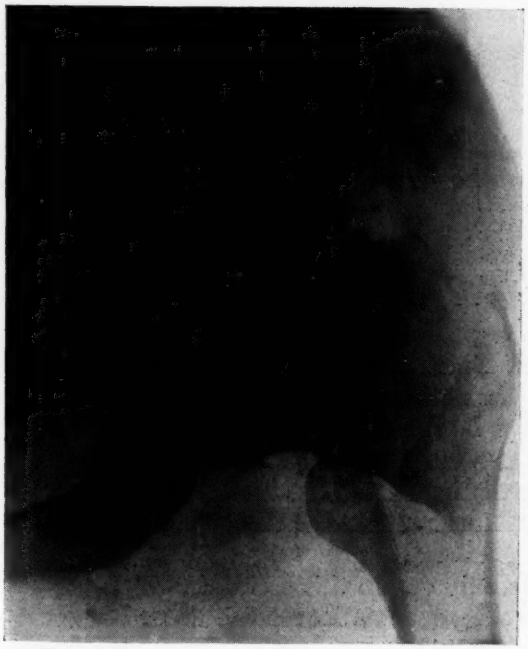

FIG. 158.—Impacted fracture through the great trochanter: the lower edge of the upper fragment is driven into the broken surface of the lower fragment.

As the fracture is caused by a forcible lessening of the angle which the femur presents at the great trochanter, the fragments are immediately driven together in such a way that the sharp lower edge of the upper fragment is driven into the broken surface of the lower fragment just above the lesser trochanter, producing such a fracture as that shown in *Fig.* 158. It will be seen that the lower point of the upper fragment is held in a V-shaped cleft just deep to the lesser trochanter,

which is seen in profile because the lower fragment has rotated outwards as the upper fragment is ground into it. It is also noteworthy that the upper edge of the comminuted great trochanter is above the level of the upper rim of the acetabulum, necessarily giving rise to the same degree of real shortening of the limb as was seen in *Fig.* 153, a fracture of the neck. The fracture shown in *Fig.* 158 is clearly an impacted fracture, but the breaking force does not always stop when the fragments have reached that position.

In *Fig.* 159 the force has continued after impaction of the fragments, and the sharp edge of the upper fragment, acting like a chisel, has split the lesser trochanter off the shaft and caused a vertical fracture to run down the inner side of the shaft for about three inches. In this injury the fracture has become disimpacted, and the great trochanter is raised to a higher level than in any of the other fractures illustrated.

FIG. 159.—Fracture through the great trochanter in which the upper fragment has split the lesser trochanter off the shaft.

FIG. 160.—Comminuted fracture of the lesser trochanter, showing the displacement by the pull of the psoas muscle.

In *Fig.* 160 the lesser trochanter, which is comminuted, has been pulled up high above its normal position by the action of the psoas muscle, and it was pointed out more than forty years ago by Sir Charters Symonds that it could be felt, clinically, in its new position as a bony swelling on the inner side of the thigh, thus giving a ready method of distinguishing between fractures through the neck and those through the great trochanter in the days when radiographs were not available.

Fig. 161 shows a rare injury, the only one in this series, in which the line of fracture runs through the great trochanter but leaves the lesser trochanter attached to the neck. In this case the break was caused by a sudden and forcible abduction of the lower limb while in a position of external rotation;

such a fall more often produces a subtrochanteric fracture than one through the great trochanter.

3. **Subtrochanteric Fractures.**—These are really fractures of the shaft, and I do not propose to say much about them. This is the type of fracture that is often produced by violent abduction of the lower limb, but it no doubt results from other causes, such as 'run-over' accidents. It is well to bear in mind, when dealing with this class of fracture, that it is the commonest part of the femur in which fractures due to neoplasms are found.

FIG. 161.—Fracture through the great trochanter in which the lesser trochanter is left attached to the femoral neck.

Accepting the above classification of fractures of the upper end of the femur, it is interesting to analyse the 341 cases and to see how they are divided among the different classes.

From the figures given in the table below it appears that fractures through the great trochanter are twice as common as fractures through the neck, and that there is no difference between the two classes as regards the period of life at which they occur. They are both injuries which occur in patients in whom the changes of old age are present. Atrophy of the bone is no doubt one of the factors predisposing to the injury, for in some of the younger members of the series the patients have had such diseases as tabes dorsalis or hemiplegia, in which atrophy of the bone is known to occur. I think, however, that weakened muscles and a lengthened period of muscle reaction, both of which are present in old age, play some part in predisposing patients to these fractures.

TYPE OF FRACTURE	MALES	FEMALES	TOTAL
Fractures through the neck	27	84	111*
Fractures through the great trochanter	93	114	207*
Fractures below the great trochanter	14	9	23

* Average age of the 111 patients 69·2 years. Youngest 33, oldest 89.
" " 207 " 69·4 " " 32 " 94.

Among patients with fractures through the great trochanter the sexes are almost equally represented, but among patients with fractures through the neck there are three women to every man. I do not know why there is

this inequality of the sexes, and have no suggestion to make. It may be that the greater width of the pelvis in women predisposes them to fracture of the neck, but I cannot see in what way it plays its part.

I do not propose to consider at length the physical signs by which fractures of the neck can be differentiated from those through the great trochanter. The diagnosis can generally, but not always, be correctly made; but as a radiograph gives so much more information than the most careful clinical examination, the clinical diagnosis is of little more than academic interest. I would, however, stress the points that neither the age of the patient nor the degree of shortening and external rotation present is in any sense a reliable factor in making the diagnosis.

TREATMENT.

1. **Treatment of Fractures of the Neck.**—When treating fractures of any of the long bones there are always four steps to be taken: (*a*) To reduce the displacement; (*b*) To bring the ends of the bone into contact; (*c*) To retain them in contact till bony union has occurred; (*d*) To restore the normal function of the limb. Our experience of fractures elsewhere in the body teaches us that if we are successful in taking those four steps we can confidently predict a good result from our treatment. Bad results of fractures of the upper end of the femur have been so common in the past that many fantastic theories have been advanced to account for and excuse such results. It was, for example, urged by Sir Astley Cooper, and has been repeated many times since, that the presence of synovial fluid from the hip-joint interfered with union of fractures of the neck; we know, however, that fractures into other joints give good results if the four steps above mentioned are taken. It has also been claimed that the blood-supply of the upper fragment is too poor to allow of bony union, but our knowledge of bone-grafts alone would be enough to show the inadequacy of this claim, even if it were true, which it probably is not.

The reason why fractures of the neck of the femur so frequently fail to unite by bone is that it has been found to be so difficult to devise a method by which the second and third of the above-mentioned steps can be secured. The upper fragment is a small piece of bone to which no muscles are attached, and the ball-and-socket joint immediately above allows it the freest movement. The lower fragment is, in effect, the whole lower limb, and the two points that we have to bring and retain in contact are deeply embedded in muscles which are in constant action whenever the patient moves the lower part of the trunk. A suspiciously large number of methods have been suggested for overcoming the difficulties that are thus made apparent; but while some of them have been successful in a small percentage of cases, the best method is that described by Whitman. Briefly stated, his method is to place the patient under an anæsthetic, to rotate the limb inwards, extend it in the direction of its long axis, abduct it as far as it will go, and, while the limb is maintained in that position, apply a plaster-of-Paris spica from the toes to above the pelvis. It is necessary to include the foot up to the toes to prevent the limb rotating inside the plaster and to carry it well above the pelvis to prevent tilting of the pelvis. We have found it better

to put on a double spica as shown in *Fig.* 162, since the surest method of fixing the pelvis is to abduct the other limb.

Fig. 163 shows a fracture of the neck of the femur, *Fig.* 164 shows the same fracture in plaster after being treated in that way, and *Fig.* 165 shows the result twelve months later. It is apparent that while the contact of the fragments was good enough to secure bony union, the reduction of the displacement was not quite perfect and there is some resulting deformity. The deformity, however, is slight, and the patient walks on a strong limb with a scarcely perceptible limp. It is always necessary to check the position by taking a radiograph through the plaster, and it not infrequently happens that two or more attempts have to be made before a good enough position is obtained.

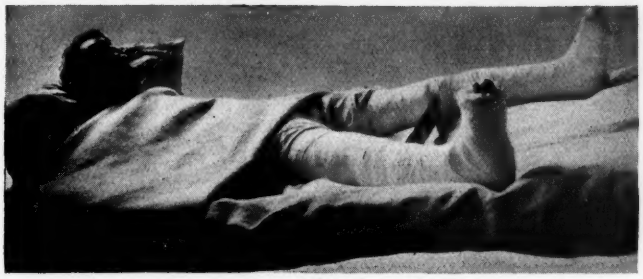

FIG. 162.—Securing bony contact and union by the double spica bandage.

The apposition of fragments in these cases is seldom as good as we could wish, and the splint must therefore be worn for a much longer time than in

FIG. 163.—Fracture of the neck of the femur.

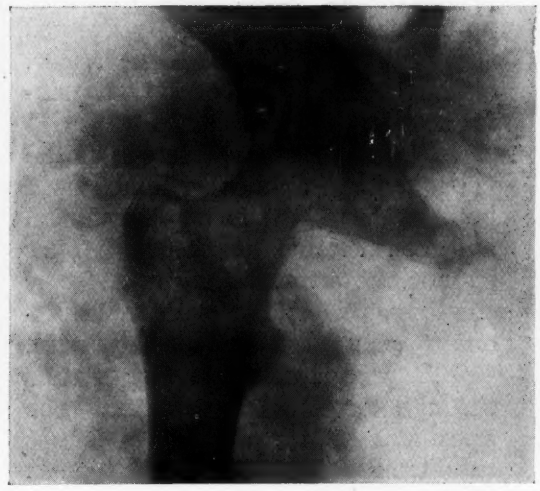

FIG. 164.—The same case as *Fig.* 163 after application of plaster-of-Paris.

fractures with good apposition. The plaster can be removed in three months and the patient allowed to walk, although it is generally advisable to let him have a well-fitting caliper for a further period of three months. During this time the restoration of the function of the limb can, of course, be hastened by massage and radiant heat to the hip region. I would here refer to a

tiresome complication, namely, stiffness of the knee of the affected limb: this stiffness is much greater than that of the sound limb, although both knees have been in plaster for the same length of time. It is, I think, due to traumatic synovitis of the knee which is so often caused at the same time as the fracture.

FIG. 165.—The same case as *Fig.* 164 twelve months later.

This is a method of treatment which demands great care and perseverance on the part of the surgeon, even greater care and skill on the part of the nurses, and patience and long-suffering of a high degree on the part of the patient. In the younger patients up to 60 or 65 it can generally be carried out, but it is usually impossible in those over 70. In such elderly patients it is generally best to be content with something less than bony union, and, if they are treated by the method to be subsequently described for fractures through the great trochanter, a fibrous union can generally be obtained that will enable them to get about, although there will always be a painful and crippled limb.

Fig. 166 shows a fracture of the neck treated in this way, and it will be seen that there is no bony union and considerable deformity. That patient, however, although a feeble old lady, was able to walk well without a stick and with but little pain.

2. Treatment of Fractures through the Great Trochanter.—The treatment of these fractures is not so difficult as those of the neck. Because the ends of the bone are driven together and not away from one another, bony union practically always occurs even if no treatment be adopted at all. But in such cases, although the union is firm, the coxa vara and external rotation are causes of considerable crippling.

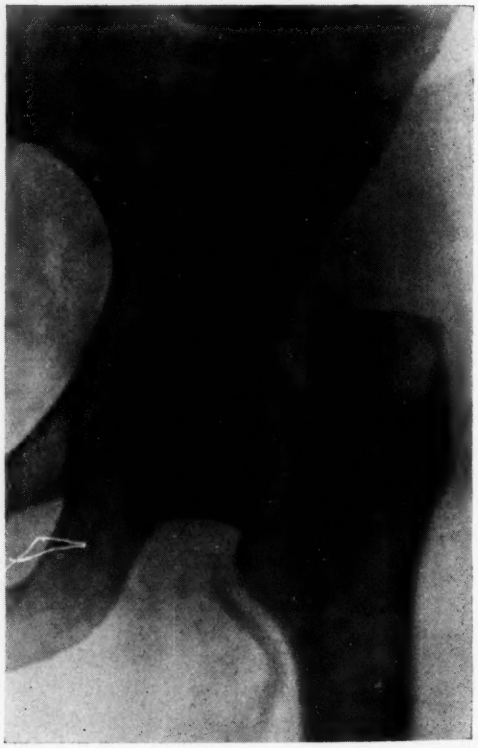

FIG. 166.—Fracture of the neck of the femur treated without plaster, showing lack of bony union and considerable deformity.

The deformity must therefore be reduced, and an anæsthetic is generally necessary. If the fracture has impacted, and remained impacted, the fragments must be disimpacted, and in doing this it is important that the lesser trochanter should not be split off the shaft. It is almost surprising to find how easily they disimpact if the attempt is made within a day or so of the fracture and the limb is axially extended, rotated inwards, and widely abducted. It is in this position that the limb must be fixed; but in these cases it is never necessary to use a plaster-of-Paris splint. The broken surfaces are so broad, and the upper fragment is so much larger than in fractures of the neck, that bony union in good position can always be obtained by an apparatus such as that shown in *Fig.* 167. In order to maintain the abduction both legs must be slung, and in order to enable nursing and other movements to be made without disturbing the fragments the limbs must be balanced by

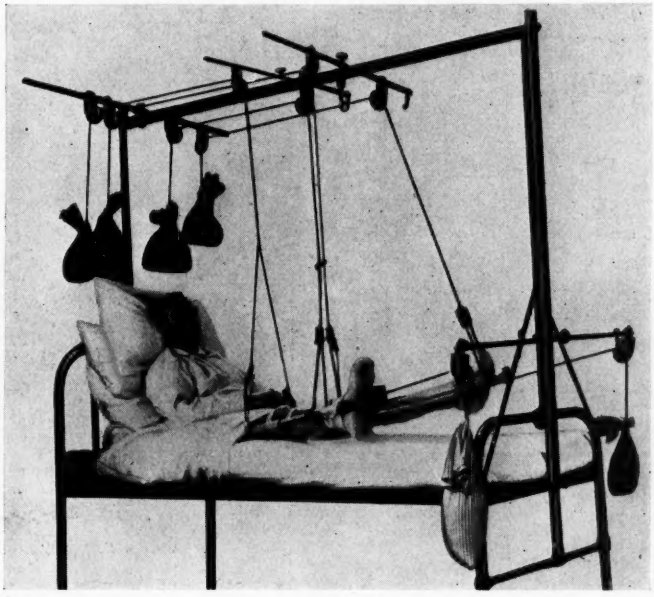

FIG. 167.—Apparatus for treatment of fractures through the great trochanter.

counterpoised weights. The limb is axially extended by a Buck's stirrup carrying, at first, a weight of about 15 lb. on the injured side and 7 lb. on the sound side, and the limb is supported on a Thomas or Hodgen frame with strips of Bavarian flannel to make a trough. The weight on the injured leg may be safely reduced by 1 lb. a week, and if this be done the restoration of function of the limb after removal of the splint is more rapidly effected. With the legs widely abducted and the patient propped in a semi-sitting position it is easy to correct the external rotation: flexion of the hip relaxes the psoas muscle, which is especially important in those cases where the lesser trochanter has been detached from the shaft. It is essential that the correction in these cases should be checked by radiographs taken with the patient in bed, and it is advisable to repeat these throughout the treatment to detect

any alteration that has occurred in the position of the fragments. *Fig.* 168 shows an impacted fracture, and it will be noticed that the shaft below the lesser trochanter is split, but the fracture is incomplete and the lesser trochanter remains in its normal position. *Fig.* 169 shows that fracture disimpacted and slung in the abducted position, and it can be seen that disimpaction has been accomplished without breaking off the lesser trochanter. The importance of this can be seen from *Fig.* 170, which shows the end-result of one of these fractures in which the main fragments are joined in good position but the lesser trochanter has been drawn upwards and inwards, where it is fixed by a mass of callus that will later become bone. Such a position results in considerable interference with the action of the psoas and instability of the hip-joint.

FIG. 168.—Impacted fracture through the great trochanter.

FIG. 169.—Same case as *Fig.* 168 after disimpaction.

FIG. 170.—End-result of a fracture through the great trochanter, showing good union of the main fragments but displacement of the lesser trochanter.

While the patient remains in this apparatus, constant and careful supervision is needed, and the nurses must thoroughly appreciate the principles that are involved. If it be remembered that the weights are so adjusted that by their pull they are holding the broken ends of the bone in the position in which

we wish them to join, it is clear that a momentary relaxation of the tension on the cords will break down in the early and distort in the later days the bone-forming material. Far too many bad results are due to the nurse who thoughtlessly lifts a weight for a few minutes to make easier a nursing duty, or to a stirrup being allowed to slip because it is not renewed soon enough. The stirrup on the injured limb nearly always needs to be renewed in course of treatment, and it is important that the extension on the limb should not be relaxed in the slightest while it is being done.

The treatment is more easily carried out satisfactorily if a fracture bed is available. Fracture beds as a rule cost about £20, but *Fig.* 167 shows one which we had built to a home-made design and costs only £6. There are four crossbars 4 ft. long on each bed, and the spring mattress is made in eight sections and built of aluminium strips carried on steel spring to give rigidity. The hair overlay is in six sections, and the sections are easily removed without

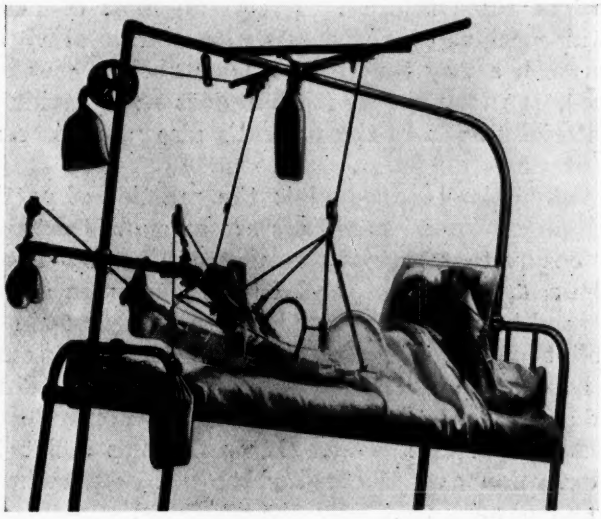

FIG. 171.—Improvised extension apparatus for treatment of fractures through the great trochanter.

altering the patient's position. If a fracture bed cannot be obtained, any carpenter or fitter can quickly build a superstructure from which the patient can be slung. *Fig.* 171 shows such a structure made by the hospital fitter out of pieces of gas-pipe, and although it looks like a Heath Robinson picture it is quite efficient and still in use at the Hospital.

Extension, in the apparatus, should be maintained for about eight to ten weeks, and at the end of that time it may be removed and the patient got out of bed and encouraged to move the limb. A pair of crutches should be provided for the first week or two, and the restoration of function is materially aided by massage and radiant heat to the hip region. I have found that the period of invalidism is shortened if the patient be got out of bed immediately after the splint has been removed, instead of lying in bed for a few days. As in fractures of the neck, the knee of the injured limb often

causes the patient more pain and trouble than the hip, and care should be given to that joint.

In none of the patients of this series has open operation been performed for a recent fracture. In those through the great trochanter, bony union in good position can, I believe, always be obtained without operation. In fracture of the neck, the hold obtained on the upper fragment by a peg or screw is so precarious that it is doubtful whether the operation would materially shorten the period of immobilization, and unless it does that it is difficult to see what advantage is to be gained by operation. Operation might be necessary if apposition of the fragments were prevented by interposed tissue; but I have never had a case in which crepitus could not be obtained when the patient was under an anæsthetic, so I do not think that it is common for there to be any structure between the fragments keeping them apart.

Before leaving treatment I should like to make a short reference to the *first-aid treatment* of these injuries. Everybody now condemns the Liston splint, but we still continue to receive patients at hospital with a long wooden splint applied in such a way that it is a gross libel to couple Liston's name with it. As used, the long wooden splint does not provide any extension, and while it materially adds to the patient's discomfort it certainly does no good and may at times do harm.

Quite as much to be condemned is the practice of putting the injured leg between sand-bags. If the sand-bags are so applied as to immobilize the limb, they only ensure that every movement of the patient's body causes a movement at the seat of fracture, and I have often seen a patient sigh with relief when the sand-bags were removed. The best first-aid treatment is a Thomas knee splint applied with an axial extension. This can well be worn for forty-eight hours, and if the patient has to be moved to hospital the splint should be slung from the roof of the conveyance as first suggested by Hodgen in the American Civil War. If no Thomas splint be available, a simple weight extension over the end of the bed or stretcher gives comfort to the patient and ensures that only the minimum of damage is done.

RESULTS.

Fractures of the upper end of the femur have always been notorious for causing a high mortality among the patients suffering from them. When we remember that the average age of patients in this series was over 69 years, it is clear that many of them were already tottering along the path that leads to the grave, and the false step that caused the fracture was but a jolt that hastened little, if at all, their arrival at the end of the journey.

Of the 111 patients with fractures of the neck of the femur, 31 died without leaving hospital. Of the 207 patients with fracture through the great trochanter, 51 died; and of the 23 subtrochanteric fractures, 6 died. These are high figures, but it must be remembered that they are those of patients admitted to a Poor Law hospital, and there are included among the deaths many who had recovered enough from their injury to enable them to leave their beds, but who were destitute and had no home in which they

could lead the lives of invalids. For example, of the 15 patients who died in the two years ending April 1 last, 8 lived over six months, and 2 for over a year after their injuries. The remaining 7 all died within thirty days of their injuries, and this latter figure gives a truer picture of the mortality due primarily to these fractures.

I have not found it possible to classify from the notes at my disposal the results as regards the ultimate function of the injured limb. The disability resulting from fractures of the neck has been much greater than that resulting from fractures through the great trochanter, but even among the former there have been many who have recovered function good enough to enable them to return to their former employment.

CONCLUSIONS.

1. Fractures of the neck of the femur are due to an axial twist of the lower limb.

2. Fractures through the great trochanter are caused by indirect violence which thrusts the head of the femur downwards while the limb is adducted and rotated outwards, tending to lessen the angle the neck makes with the shaft.

3. Direct blows on the great trochanter do not fracture the femur, but, if the force be great enough, cause fractures through the acetabulum.

4. There is no difference in the ages at which fractures through the neck and fractures through the great trochanter occur. The average age of 111 patients with the former was 69 years 2 months, and of 207 with the latter was 69 years 4 months.

5. Fractures through the neck are best treated by a Whitman's plaster, but age and debility often prevent this.

6. Fracture through the great trochanter, if impacted, should be disimpacted, and in all cases treated by suspension and extension with the limb in an abducted position.

A CASE OF NEUROCYTOMA OF THE ADRENAL.

By MAURICE DAVIDSON,
PHYSICIAN, MILLER GENERAL HOSPITAL, LONDON;
AND E. WESTON HURST,
PATHOLOGIST, MILLER GENERAL HOSPITAL, LONDON.

THE following case appears to us sufficiently uncommon to be worth placing on record.

The patient, a little girl, age 3½, was admitted to the Miller Hospital on Sept. 10, 1926, having been ill for a week with headache and abdominal pain. There had been no diarrhœa or vomiting, but the child was said to have had several fits. On examination she appeared thin and very pale; the temperature was 101·8°, the pulse 140. The abdomen was distended, some free fluid being present, and was 'doughy' to the touch; some indefinite masses were felt in the region of the umbilicus and also below the right costal margin. The latter were thought to be thickened masses of omentum and matted coils of intestine, the clinical picture as a whole suggesting a condition of tuberculous peritonitis. The blood-count was as follows: Total red cells, 3,940,000; total white cells, 4900; hæmoglobin, 50 per cent; colour index, 0·7. Differential leucocyte count: polymorphonuclears, 42 per cent; large and small lymphocytes, 48 per cent; hyalines, 8 per cent; eosinophils, 2 per cent; mast cells, 0 per cent.

During the next few days the temperature varied between 98° and 103°, and the pulse-rate averaged 150. The child complained alternately of abdominal pain and headache, and her increasing irritability was thought to be heralding the onset of tuberculous meningitis. At the end of three weeks, however, no cerebral manifestations had appeared and the ascites had markedly increased. There being no abnormal physical signs in the chest and no clinical evidence of general dissemination of disease, it was thought that the case was one of abdominal tuberculosis of the ascitic variety in which benefit might result from opening the abdomen. Mr. Cecil Joll, who was asked to see the patient in consultation, agreed with this view, and laparotomy was performed by Mr. Kelman on Sept. 30. The peritoneal cavity was found to be full of dark blood-stained fluid, which was slowly evacuated. Enlarged glands were found in the mesentery; the great omentum was much matted but was not hard; nodular masses were found scattered over the parietal peritoneum in the epigastric region. Some free hæmorrhage was seen to be occurring from the region of the great omentum; this was apparently from a small vein and was dealt with at once, the abdomen being closed as soon as possible owing to the patient becoming collapsed, a small portion of one of the nodular masses being quickly excised for examination. The child's condition became progressively weaker, and she died on Oct. 15, a fortnight after the operation.

Post-mortem Examination.—The body was emaciated, the abdomen being considerably distended. After removal of about four pints of deeply blood-stained fluid, attention was arrested by numerous masses of a greyish or pinkish-white colour scattered everywhere throughout the abdominal cavity. The omentum was represented by agglomerated portions of the above, the mesenteric glands by larger nodules soft and friable in character, and the retroperitoneal glands by still larger deposits. Both flanks contained quantities of tumour tissue which on the right side invaded the under surface of the liver and extended as a continuous growth into the right iliac fossa. The spleen was moderately enlarged, but was otherwise normal in appearance. The kidneys, situated behind the tumour tissue, were unaffected; the left suprarenal body lay in the usual position and was intact, but on the right side the kidney was capped by a huge mass of growth in which no suprarenal structure could be detected. A few small nodules were attached to the surface of the uterus; the ovaries were normal. The stomach and intestines were normal. None of the viscera showed invasion by the growth except the liver, which, as already stated, was penetrated to the extent of a few centimetres from the surface. Whereas on the under surface of the diaphragm only a few small nodules were seen, from the upper surface, especially on the left side, large masses projected into the thoracic cavity. The left lung was compressed by these and by about a pint of puriform fluid, so that only the extreme apex was aerated; the right lung was compressed in much less degree by the growth and by a few ounces of clear yellowish fluid; there was no actual invasion of the lung tissue itself. The heart and pericardium were normal, but the mediastinal glands were replaced by large nodules of growth. Outside the thoracic and abdominal cavities no trace of growth was found either in the glands or elsewhere. The brain was normal.

Microscopical Examination.—The structure of the tumour was fairly constant. The constituent round, oval, or spindle-shaped cells varied in size, their diameter being from once to twice that of a polymorphonuclear leucocyte. They lay singly, in lines of one to half a dozen cells, or in groups of two or three to twenty or thirty, and occasionally in large groups and columns containing as many as several hundred cells. In some cases the individual cell outlines could be distinguished, in others the cytoplasm seemed common to a number of nuclei. The nuclei themselves were round or oval, sometimes indented or reniform in shape, and contained both coarse and fine points of chromatic material and from one to three large nucleoli. The cytoplasm, owing to its small amount and to its basophilic reaction when stained with iron alum hæmatoxylin and eosin, was not easily recognized with low powers of the microscope. Degenerative changes were not frequently seen. Mitotic figures were fairly common—in most fields one or two could be distinguished under the $\frac{1}{6}$ objective. The cell groups were separated by numerous areas in which ran a number of thin-walled vessels consisting mainly of an endothelial lining supported by a delicate connective-tissue layer; other larger spaces were lined by only a single layer of endothelium, and were frequently filled with masses of tumour elements. Apart from the vessels, the intercellular spaces were occupied by a finely fibrillated ground substance (*Fig.* 172), and in favourable circumstances the tumour-cell cytoplasm was seen to be prolonged

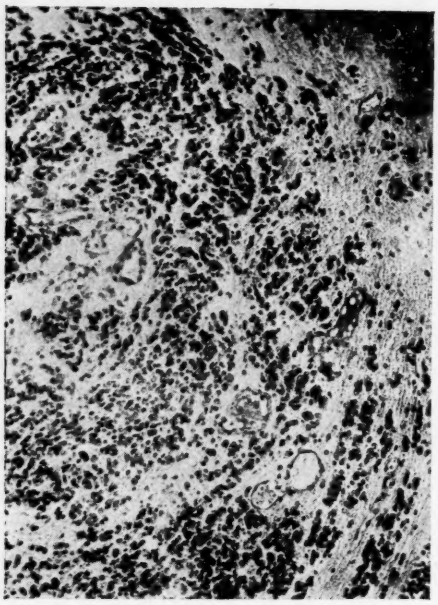

FIG. 172.—Showing tumour cells and fibrillated ground substance. Microphotograph (low power).

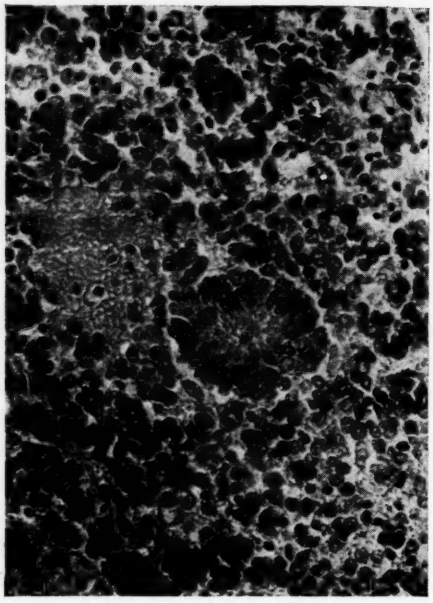

FIG. 173.—Showing portion of tumour from which the coloured drawing was made to illustrate rosette with central radial striation. Microphotograph (high power).

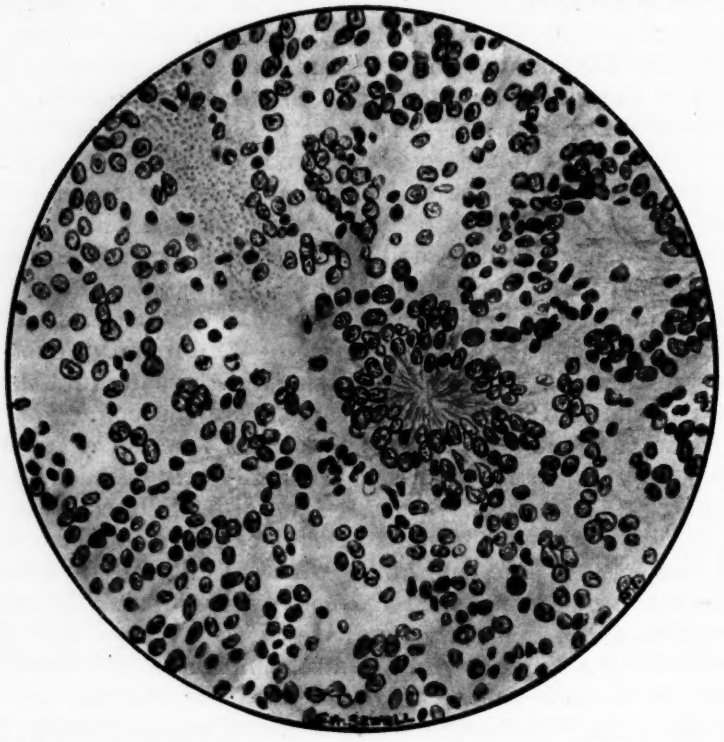

FIG. 174.—Coloured drawing to illustrate details of *Fig.* 173. (× 270.)

into definite processes which were connected with the fibrils. The fibrils stained pale pink with eosin, brownish in van Gieson sections, and a reddish green (quite distinct from the brilliant green of collagen fibres) in hæmatoxylin-fuchsin-ponceau-light-green preparations. With Foot's method[1] for reticulum fibres a negative result was obtained, and specific stains for neuroglia also failed to colour the fibrils. In many areas the growth was freely infiltrated by polymorphonuclear leucocytes, and hæmorrhages were not infrequent.

While from the above description it will be seen that for the most part the arrangement of the tumour cells was more or less haphazard, in a few places a more positive arrangement was encountered. After careful searching through a number of sections, certain areas were noted in which the nuclei of a small group of cells were arranged peripherally while the cytoplasmic processes were directed centrally and were sometimes distinctly fibrillated with resulting 'rosette' formation; very rarely a small cavity formed the centre (*Figs.* 173, 174).

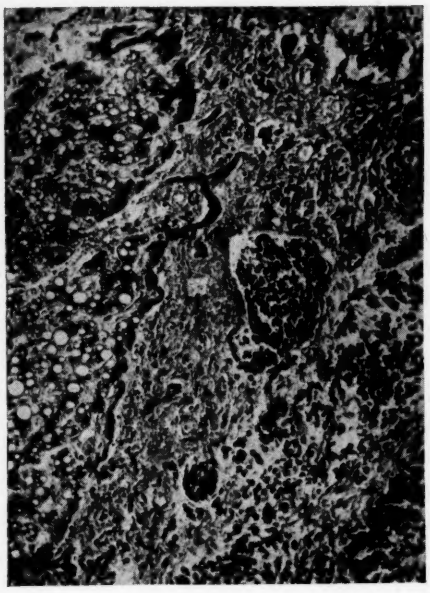

FIG. 175.—Showing liver invaded by growth. Microphotograph (low power).

The spread of the tumour was mainly along the lymphatic channels, and in some of the lymph glands in an early stage of invasion numbers of malignant cells could be seen blocking the lymph sinuses. The larger spaces filled with neoplastic elements, in the older parts of the growth, appeared to be lymphatic channels and not blood-vessels. In the liver there was definite deposition of fibrous tissue between the advancing edge of the tumour and the compressed and atrophied liver cells (*Fig.* 175), but beyond this limit groups of malignant cells could be seen in the hepatic sinusoids between the columns of liver cells.

DISCUSSION.

In discussing the nature of this tumour a point of some importance to be decided is whether the right suprarenal body, of which no trace was found at the autopsy, was merely replaced by growth or was actually its site of origin. The latter alternative appears to us on the whole more probable. Before giving our conclusions we think it may be of interest to give the following brief résumé of the literature available on the subject of adrenal tumours.

Pepper[5] in 1901 described a growth of this gland which he considered to be a lymphosarcoma, becoming evident soon after birth and giving rise to diffuse infiltration of the liver. In the type of adrenal 'sarcoma' described by Hutchison[3] metastases occur typically in the cranial and other bones as

well as in the liver. Frew[2] showed that this difference in distribution of the metastases depends on the different lymphatic drainage on the two sides; from the left adrenal gland secondary deposits are found in the liver, ribs, and cranial bones, and also in the thoracic duct and some of its tributaries, while on the right side the growth spreads at the bare area to the surface of the liver, and to the kidney, pleura, and lung, thus tending to remain localized in the abdomen and thorax. Wright[6] gives adequate reasons for considering these growths as neurocytomata arising from the medullary cells of the adrenal, and Masson[4] also describes them as of sympathetic origin. Although formation of 'rosettes' is typical of the neurocytomata, Masson states that they are found most readily in the less malignant neoplasms; in their absence the tumour may be indistinguishable from lymphoblastic sarcoma, a common diagnosis in these cases before their true nature was realized.

In the present case we were led to class the growth as a neurocytoma by reason of: (1) The nuclear characteristics; (2) The scanty cytoplasm; (3) The separation of masses of cells by bundles of fibrils not staining like collagen, neuroglia, or reticulum, and the obvious origin in some areas of these fibrils from spindle-shaped tumour cells; (4) The attempts at 'rosette' formation. This diagnosis was not, however, made without considerable deliberation. At first, indeed, we were inclined to regard the tumour as mesodermal in origin, and it was only after the application of special staining methods and the discovery, by a careful search through a number of sections, of occasional 'rosettes' that the true nature of the growth became obvious. A study of the literature shows that neurocytoma is a well-recognized entity. That the condition is not so very uncommon is suggested by Masson's statement that he has personally met with five cases within three years. Nevertheless, it seems probable that a number of the more malignant (and less differentiated) examples are wrongly diagnosed, for in a case like the one under discussion an ordinarily careful routine examination of a few sections only may well fail to reveal the characteristic cytological grouping which places the diagnosis beyond doubt, and even if occasional imperfectly-formed 'rosettes' are found, these may be taken for a mere chance arrangement of the tumour cells.

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[4] Masson, *Traité de Pathol. Méd.*, Paris, 1923, 27.
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[6] Wright, *Jour. of Exper. Med.*, 1910, xii, 557.

TYPES OF GALL-BLADDER INFECTION: A STUDY OF 100 OPERATED CASES.*

By C. F. W. ILLINGWORTH, Edinburgh.

The frequent occurrence of bacterial infection in diseased gall-bladders has long been recognized, and its importance as one factor in the production of gall-stones is now hardly in doubt—indeed, some go so far as to assert that it is the primary or even the sole cause of nearly all stones in this situation—but the relative frequency of different types of organisms, their original foci, and their routes of approach to the gall-bladder are still subjects for discussion.

Bacterial investigations of diseased gall-bladders have in the past been limited for the most part to smear and culture examinations of bile obtained at operation, and these in the hands of different workers have yielded results which vary greatly both in the frequency and in the nature of the infecting organisms isolated. Thus Hartmann[1] found an infection of the bile to be present in a considerable majority of cases, whereas Johnson[2] and Drennan[3] found it to occur in only 32 per cent and 19 per cent respectively. In the experience of all these workers *Bacillus coli* was the organism of most frequent occurrence, whereas in Huntemueller's[4] series staphylococci headed the list and were found twice as often as the coliform organism. All are agreed, however, that the bile of even grossly diseased gall-bladders is sterile in quite a large proportion of cases, and Rosenow[5] has shown that it is only by making cultures from the gall-bladder wall itself that an accurate idea of the infection present may be obtained. In his experience the organism most frequently found by such an examination is a streptococcus.

There are several routes by which organisms from other foci in the body may reach the biliary tract and the gall-bladder. The earliest conception, that of an ascending infection from the duodenum along the common and cystic ducts, is not now generally supported as a mode of origin of cholecystitis, except perhaps in rare cases. Whilst it seems probable that infection against the slow bile current *may* take place, its occurrence is unlikely, especially as the duodenal content, even in known cases of cholecystitis, contains pathogenic organisms in only a small proportion of cases.

There remain, therefore, three possible routes to the gall-bladder: (1) The organisms may reach the liver either in the systemic blood-stream or by the portal circulation and be excreted in the bile. (2) Having reached the liver they may set up a localized, low-grade hepatitis, and spread thence to the gall-bladder by way of the lymphatics (Graham[6]). Similar lymphatic extension might also occur from neighbouring viscera—stomach, duodenum, pancreas, and possibly appendix. (3) They may pass in the systemic blood-

* From the Clinic of Professor Wilkie in the Royal Infirmary, Edinburgh, and the Department of Surgery, Edinburgh University.

stream from some distant focus direct to the gall-bladder, there to set up an intramural infection, and later to infect the bile (Rosenow[5]).

A clearer knowledge of the etiology of cholecystitis would seem to be of some importance for the treatment or even the prevention of this disease, and it is with this object that the investigation recorded below has been carried out. It consists of a bacteriological examination of a series of gall-bladders operated upon by Professor Wilkie. By his courtesy I have been able, in 100 cases, to take portions of the gall-bladder wall in addition to samples of the bile, or other fluid content, for culture. Wherever possible the cystic lymph gland has also been identified and dissected off the cystic duct for a like purpose, and in many cases stones removed have been similarly examined.

In carrying out this work I have endeavoured especially to answer the following questions :—

1. Is the gall-bladder wall or the bile more frequently the site of a demonstrable infection, and what organisms are most commonly found in these two sites ?

2. Is any one organism more constantly present in the early stages of the disease and therefore likely to be an active agent in its production ?

3. Is there any evidence that any one of the routes of approach referred to above forms the usual path ?

METHOD OF EXAMINATION OF TISSUES REMOVED AT OPERATION.

The medium used for culture of the tissues removed has been the glucose-brain-broth recommended by Rosenow.[7] It is made by adding fragments (1 grm.) of brain tissue to tall tubes of ordinary broth, sterilizing in the autoclave, and adding glucose to make a 0·2 per cent solution. The advantage claimed for this medium is that it gives a gradient of oxygen pressure, from complete aerobiosis at the surface to relatively anaerobic conditions near the bottom of the tube, and it seems especially suitable for culture of the rather slow-growing organisms occurring in cholecystitis. To exclude contamination as far as possible, the specimen—gall-bladder, bile, or other tissue—should be dealt with immediately after its surgical removal, since any delay even in the relatively sterile air of an operating room naturally increases the risk.

Collection of the bile by means of a syringe or a sterile swab presents little difficulty ; but the gall-bladder, exposed to manipulation and to contact with the wound surfaces, requires greater care if contamination is to be avoided, and the portion to be incubated should be washed thoroughly in several changes of saline before it is transferred to the culture medium. In addition, in some of the more recent cases a further safeguard has been adopted, and the tissue, removed and washed as before, has been sterilized on its surface by exposure to ultra-violet rays. It was found that if the portion of tissue was picked up in fine-pointed forceps and exposed at a distance of 5 in. to the rays of a 7-ampère tungsten arc, an exposure of one minute sufficed to destroy even gross surface contamination, and as the rays

have little penetrative power, any organisms present deeper in the tissue are unaffected.

Table I.—Results of Cultures from 100 Gall-bladders.

Tissue	No. Examined	No. Infected	Streptococci	Coliforms	Streptococci and Coliforms	*Staph. aureus*	*Staph. albus*	Unidentified Bacillus
Gall-bladder wall ..	100	62	34	17	5	1	5	0
Bile	100	40	16	20	1	1	2	0
Crushed stone ..	23	7	2	3	0	1	1	0
Cystic gland	15	6	3	2	0	0	0	1

Table I shows the incidence of infection found in the various sites, and also the nature of the organisms present. It will be seen that cultures of the gall-bladder wall showed the occurrence of an infection in a large percentage of cases (62) as compared with the bile, which in the majority of cases was sterile. The nature of the infecting organisms also differed very considerably in the two sites, for streptococci, which predominated in the gall-bladder wall, were often found to be confined to this situation, and the gall-bladders thus infected in many cases contained sterile bile. Infection of the bile, on the other hand, was, in exactly half the total number infected, due to coliform organisms, and in these cases the gall-bladder was generally found to give a growth of the same nature.

Mixed infection, as will be seen, occurred in but a few instances, and *Staphylococci aureus* and *albus* were also rather infrequent. *Staph. aureus* occurred on three occasions—once in the gall-bladder wall, once in the bile, and once in the cultures from a crushed stone. My attention was recently drawn to the observation of R. R. Graham,[8] that the isolation of this organism is frequently associated with a clinical history of mucous colitis, and it is therefore interesting to note that in the three cases here recorded this was not present—indeed, two of the patients had a definite history of chronic constipation.

Examination of crushed gall-stones proved rather disappointing. Infection was present in only 7 out of the 23 examined, and in 4 of these contamination from the bile, which yielded the same organisms, could not be absolutely excluded. Cultures from the cystic gland also afforded little information, and in every case but one gave a growth similar to that of the gall-bladder or bile.

With regard to the clinical recognition, at operation, of cases likely to be found infected, the general impression gained was that a positive culture from the gall-bladder was more likely to be obtained in a case where the wall was thick and fleshy than where the changes were less marked. Infection of the bile, on the other hand, was more difficult to estimate from the naked-eye appearance. In some cases perfectly clear watery bile yielded a vigorous

growth on culture; yet in others, where the gall-bladder content was thick, turbid, and of almost stercoraceous appearance, no growth could be obtained.

CLASSIFICATION OF THE ORGANISMS ISOLATED.

All the coliform bacilli isolated were as a routine inoculated into tubes of lactose peptone and on to McConkey plates, and with one exception they showed the reactions of 'typical *B. coli*'. In the exceptional case, where lactose fermentation failed to occur, an acid reaction took place with saccharose, and the identity of the organism was established as 'atypical *B. coli*'. The interest of this series lies in the fact that the typhoid bacillus was never isolated, although at least three of the patients had a previous history of this fever. This is in confirmation of the experience of Judd,[9] who failed to isolate this organism from 21 patients who had previously suffered from the disease.

Of the streptococci isolated, the majority had many characters in common. They grew rather slowly, and in broth after twenty-four hours or even forty-eight hours only a faint diffuse opacity might be evident. Films showed the cocci chiefly in short chains, but also often in pairs, and usually of rather small size. On agar and blood-agar the growth was also slow, and the colonies, minute, discrete, and colourless, but often in great numbers, even after forty-eight hours could sometimes be readily observed with the aid of only a hand lens. In films from solid media diplococci were rather more evident, and in some cases tended to form clumps.

In the 32 cases where subcultures were made on to blood-agar, hæmolysing streptococci occurred only 3 times; green discoloration of the medium was observed in 3 cases, and in the remaining 26 no hæmolysis took place.

In 21 cases the streptococci were typed according to Holman's classification,[10] and it will be seen that in spite of their superficial similarities wide differences of biochemical reaction existed.

Table II.—Classification of Streptococci from 21 Gall-bladders.

No. of Cases	Hæmolytic	Lactose	Mannite	Salicin	Classification
2	No	Acid	Acid	Acid	*Str. fæcalis*
4	,,	,,	,,	No acid	*Str. non-hæmolyticus 1*
1	,,	,,	No acid	Acid	*Str. mitis*
7	,,	,,	,,	No acid	*Str. salivarius*
5	,,	No acid	,,	,,	*Str. ignavus*
1	Yes	Acid	,,	,,	*Str. anginosus*
1	,,	No acid	,,	Acid	*Str. equi*

Growth of the streptococci in the peptone water used for sugar media is apt to be rather uncertain, and accordingly it was customary to inoculate a large quantity—1 c.c.—of the broth culture into each tube; and in cases where even then growth was doubtful after three or four days' incubation control tubes of agar were then inoculated from the sugar media to determine this point. Absence of inulin fermentation was relied upon to exclude the pneumococcus, which did not occur in this series.

FREQUENCY AND TYPE OF INFECTION IN VARIOUS STAGES OF CHOLECYSTITIS.

In *Table III* all the cases examined have been grouped according to the stage of disease present. As many classifications of affections of the gall-bladder seem to be of a needlessly artificial character, the various grades of disease merging into each other, I have attempted to simplify the grouping as far as possible, and the primary groups have been limited to three, depending upon the naked-eye characteristics of the gall-bladder wall rather than on other factors such as the presence or absence of stones. A fourth group has been added, consisting of those cases in which to the naked eye a localized or diffuse deposit of lipoid material was visible in the mucosa; all these cases showed distinct evidence of chronic inflammatory changes, and they are therefore also included in *Group* 2.

Table III.—Location of Infection in Various Types of Cholecystitis.

Group	No. of Cases	Wall Infected	Content Infected
1. *Acute cholecystitis* ..	12	10	10
'Empyema' ..	8	8	8
Early obstruction..	4	2	2
2. *Chronic cholecystitis* ..	65	41	25
With stones ..	52	33	21
Without stones ..	10	6	3
Hydrops	3	2	1
3. *Early cholecystitis (chronic)*	23	11	5
With stones ..	7	3	3
Without stones ..	16	8	2
4. *Cholesterosis*	6	4	2

Group 1: Acute Cholecystitis.—The symptoms arising from acute cholecystitis are rarely sufficiently grave to require an immediate operation unless or until the cystic duct has become obstructed, and it therefore happens that this had occurred in all the cases in this group.

Following obstruction of the duct in 8 of these cases an empyema of the gall-bladder had developed, and it was tense, thick-walled, and acutely inflamed. As was to be expected, cultures showed the presence of organisms in each of these cases, in the wall as well as in the contained pus. Streptococci occurred 4 times and in 2 cases were hæmolytic; *B. coli* were present 3 times; and the two organisms were found together once.

In the remaining 4 cases of this group operation was performed early during the attack, and though the gall-bladders were obstructed, distended, and thick-walled, they contained comparatively clear bile and only a slight excess of mucus. Only two of these cases showed the presence of an infection, streptococcal in one and coliform in the other.

Group 2: Chronic Cholecystitis.—This group includes the type of case most frequently seen at 'interval' operations, in which the gall-bladder shows

to the naked eye moderate or gross thickening of its walls, but no evidence of an acute infection. Stones were present in 52 uncomplicated cases of this group and absent in 10. In 3 a stone impacted in the cystic duct or in Hartmann's pouch had given rise to a slow distention—a hydrops—of the gall-bladder.

In this group, naturally, infection was considerably less frequent of occurrence than in the first, and was only found in 41 of the 65 cases. The most noteworthy feature was that in a large proportion of these a pure growth of streptococci was obtained in cultures of the wall, and that in many the organisms were found in this situation only, the bile being sterile. It is also of interest to note that such a purely intramural infection often occurred where stones were present in the gall-bladder, and indeed almost as frequently in the presence of stones as in their absence. (*See also Table V.*)

B. coli occurred in the bile in 13 cases; in the wall, in pure culture in 11 and along with streptococci in 3. *Staphylococcus albus* was found twice in the bile and thrice in the wall and *Staphylococcus aureus* was present once in each situation.

Group 3: Early Cholecystitis.—In this group are those cases, 23 in number, in which the pathological changes visible in the wall of the gall-bladder were relatively slight—loss of normal blue colour, a little thickening of the wall, and perhaps a small excess of subserous fat. Stones were present 7 times and were absent in 16. Here also the occurrence of an intramural infection was a notable feature. Streptococci were found in the wall on 6 occasions, *B. coli* twice, the two together once, and *Staphylococcus albus* twice. The bile in 2 cases contained streptococci (once the bile alone was thus infected and the wall was sterile), in 2 *B. coli*, and in the remainder proved sterile.

Group 4: Cholesterosis.—In 6 of the cases in *Group* 2 there was visible in the mucosa some degree of lipoid infiltration (cholesterosis), varying in extent from a patchy distribution over small areas to a fully developed 'strawberry' appearance. No case was encountered of cholesterosis without also definite inflammatory change, and in 4 cases stones were also present. Streptococci occurred in the wall of 3 and in the bile of 1, whilst *Staphylococcus aureus* was found in the wall of 1 case and in the bile from another.

INCIDENCE OF INFECTION IN DIFFERENT LAYERS OF GALL-BLADDER WALLS.

It has frequently been observed that even in grossly diseased gall-bladders the greater part, or in some cases even the whole, of the histological change is confined to the outer layers of the wall, and the stroma and epithelium of the mucosa are relatively healthy. This observation is important in relation to the etiology of the disease, and has been stressed especially by Graham as evidence that the infection may spread by lymphatic channels from the liver. In the hope that a similar localization of the infection might be demonstrated bacteriologically, the following method was carried out in 30 cases, separate portions of the mucosa and of the outer layers of the wall being incubated separately.

The gall-bladder, immediately after removal, was held on the stretch by four pairs of tissue forceps, and a small area of the outer part of the wall, peritoneum, and subserous and muscular coats was then dissected off the underlying mucosa, care being taken not to open into the lumen of the organ. The underlying mucosa was then also removed, and each portion, after thorough washing, was added to culture medium.

Table IV.—Incidence of Infection in Different Layers of the Gall-bladder Wall.

	Cases
Both layers sterile	9
Same organism from each layer (streptococci in 11, *B. coli* in 4)	15
Infection of mucosa alone (streptococci in 2, *B. coli* in 2)	4
Infection of outer layers alone (streptococci)	1
Streptococci in outer layers, *B. coli* in mucosa	1
Total	30

It will be seen that in the majority of the 30 cases separate cultures of different layers of the wall yielded little further information. In 9 both layers were sterile, and in 15 the same organism was isolated from each. Consideration of the table would seem to show that in the remaining cases the mucosa shows a greater incidence of infection, but it happened that in two of the instances in which this was the finding the bile was similarly infected, and contamination from this source might have occurred.

In this short series, therefore, there has been found no evidence that one or other of the layers of the gall-bladder wall is more prone to infection.

Table V.—Occurrence of an Intramural Streptococcal Infection in the 88 Interval Cases,

Naked-eye Appearance of Gall-bladder	Total No. of Cases	Intramural Streptococcal Infection
Stones present	62	13
Chronic cholecystitis (including hydrops)	55	13
Early cholecystitis	7	0
Stones absent	26	7
Chronic cholecystitis	10	2
Early cholecystitis	16	5

DISCUSSION.

The most interesting point which emerges from the study of this series of cases is the comparatively frequent occurrence of a purely intramural streptococcal infection. In Rosenow's opinion such a localization of the organisms is due to a direct blood-spread from distant foci such as the teeth or tonsils, and in support of it he has been able to demonstrate experimental cholecystitis following the intravenous injection of organisms of this type. Whether cholecystitis in man occurs in this way, or is due, as suggested by Graham, to spread of the infection by lymphatic channels, remains a moot point. The evidence given by this work does, however, tend strongly to

corroborate the present-day opinion that spread of the organisms via the bile, either from the liver or from below, is not the usual route, and indeed probably occurs only rarely, if at all.

It is difficult to correlate the presence of gall-stones, which were found in 13 out of 20 cases, with an infection entirely limited to the wall, and it seems likely that in these cases the infection had not at all times been so circumscribed. No doubt, during small acute exacerbations of the disease, infection spreads to the bile, which later, through its slight antiseptic power and by the continual fresh flow from the liver, once again becomes sterile.

In relation to diagnosis the investigation here recorded is of interest, as it affects the Meltzer-Lyon test, for, in view of the occurrence of uninfected bile in 60 per cent of cases it seems obvious that a negative bacteriological finding in this examination must be of no significance, and in fact it does not even exclude the presence of gross gall-bladder disease.

In regard to treatment of cholecystitis, the presence of active infection deep in the wall of the gall-bladder, as opposed to a catarrh of its mucosa, tends to diminish one's faith in those therapeutic measures which are directed solely to disinfection of the bile, and to emphasize the value of operative treatment. It would also suggest that, at any rate in the great majority of grosser lesions, drainage by cholecystostomy is insufficient to eradicate the disease and that cholecystectomy is the operation of choice.

In conclusion, I would like to express my great indebtedness to Professor D. P. D. Wilkie, who first suggested this research and has throughout been at considerable pains to render it possible.

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INCONTINENCE OF URINE OF RENAL ORIGIN.

By R. CAMPBELL BEGG,

GENITO-URINARY SURGEON, WELLINGTON HOSPITAL, N.Z.

The developmental anomaly here described and illustrated is doubtless rare in itself. It is manifested, however, by a very common symptom—incontinence of urine, and is accordingly of general interest and importance. The literature abundantly illustrates how often these cases have escaped diagnosis. This is the more to be regretted, as surgical intervention will in all cases relieve the unfortunate sufferers from an affliction which makes life a burden and shuts them off from all social activity. The only reference that can be found in the English literature is in an article by Milton in the *Lancet* of 1893. This author describes a case of his own and refers to a previous one of Lawson Tait's. These were almost certainly examples of incontinence due to an aberrant ureter, though they were not described as such.

Strictly speaking, the flow of urine from the urethra or vestibule from a ureter opening outside the bladder is improperly described as 'incontinence of urine', a term generally restricted to pathological leakage from the bladder. The patients, however, always present themselves as cases of incontinence and are habitually treated as such, and it seems more convenient to deal with the subject under this head.

CASE REPORT.

Eileen K., age 6, admitted June 18, 1925.

History.—The mother noticed nothing abnormal for the first eighteen months. After that time she observed that the child's clothes were always wet. There was no nocturnal enuresis, but always in the morning a slight stain on the sheet. Urine was passed naturally in the morning and at intervals during the day—the usual amount at each evacuation being 4 oz. At first there was no offensive smell from the discharge, but this became a noticeable feature after the age of 3 years. The patient had been treated by means of atropine and belladonna given by the mouth, and later by instillations of silver nitrate and vaccines of *B. coli*, but without result. Sometimes for a day or two there would be practically no leakage, and then an increased amount would follow. The family history was unimportant.

On Examination.—The patient was a bright, healthy-looking child. Neither kidney was palpable or tender, and there was no tenderness or dullness in the suprapubic region. The vulva was slightly reddened and very moist. Urine dripped away from the urethra in series of ten to fifteen drops; there would then be an interval of about thirty seconds and then another series of drops. The escaping fluid seemed to fill the vagina and then overflow from it. A small rubber catheter was passed, and it was noted that the point of the instrument appeared to be held up momentarily as if by a fold of mucous membrane just before it entered the bladder. Two ounces of urine were withdrawn, and this on examination contained a few pus cells and a large number of *B. coli*.

Cystoscopic Examination.—The bladder mucosa was normal in appearance. The right ureteric orifice was similar in appearance to the left, but different in

position. It lay more medially and nearer to the bladder neck. The efflux from both ureters was forcible and occurred at intervals of twenty seconds. The internal sphincter appeared to offer the normal resistance to the passage of the instrument.

Ten c.c. of indigo-carmine solution had been injected into the gluteal muscles immediately before the examination. The dye appeared in strong stream and good concentration from both sides fourteen minutes from the time of injection. The cystoscope was withdrawn and the bladder emptied; the solution filling the bladder was then quite blue. The drip from the urethra recommenced, but it was absolutely clear. Testing it by absorption with filter paper proved that there was no trace of dye. A catheter was then inserted into the bladder and deep-blue urine withdrawn, while clear fluid continued to emerge at the side of the catheter. It thus became evident that the bladder was not the source of the leakage, and that the kidneys corresponding to the two ureters debouching in the bladder were of normal function.

Careful urethroscopic examination of the vagina showed that there was no abnormal orifice there, nor could one be found in the vestibule. Every instrument passed hitched up momentarily against an obstacle just outside the bladder and seemed to ride over a fold or irregularity before it passed on. A No. 4 ureteral catheter passed freely to the pelvis of the left kidney, but would enter the right ureter for 1 cm. only. At this point it was gripped and blood emerged from the ureter when an attempt was made to pass it further. This appeared to show that the right ureter was narrower in bore than the left or that it was inflamed. Three hours after the examination there was a slight blue colour in the fluid leaking from the urethra.

X-ray Examination.—A radiograph showed a shadow of the left kidney normal in size, shape, and position, but the outline of the right kidney was blurred. Sodium iodide solution was injected forcibly into the urethra in the hope of outlining the abnormal ureter, but, not unexpectedly, the resulting radiograph showed nothing but a normal cystogram. On account of the age of the child and the smallness of the urethra, it was impossible to conduct a satisfactory urethroscopic examination.

Pre-operative Diagnosis.—It was evident that the case was one of supernumerary ureter on one side or the other, terminating in the urethra just outside the neck of the bladder. The orifice was probably at the point where the catheter was held up. The ureter must belong to the upper pole, following the invariable rule that the lower and more medial of the two ureters in a double kidney always belongs to the upper pole. The dye test showed lack of function and almost certainly hydronephrosis of the extra kidney, in which infection was also present. The normal part of the double kidney and the kidney of the opposite side were of good function, but also infected, one or both. The presence of an infected hydronephrotic kidney indicated its removal by partial nephrectomy rather than any handling of the abnormal ending of the ureter. The difficulty was to determine on which side the double kidney was. The possibility of the presence of two aberrant ureters, one from each side, was thought of, but seemed too remote a contingency to consider seriously. No help was obtainable from palpation or history of pain on one side or the other. The plain X-ray helped to the extent that the left kidney shadow was not enlarged and the notch of the sinus appeared in its centre, whereas if the kidney had been double, the notch would either not have been so distinct or would have been situated lower down. The right outline was too blurred to give information one way or the other. The right ureter was implanted abnormally low in the bladder and its bore was smaller than that of the left; finally, in over 80 per cent of the cases recorded where the ureter opened into the urethra the abnormality was on the right side.

Double pyelography was considered, as one pelvis might show a shortening; but as it was impossible to introduce an opaque catheter into the aberrant ureter or the right normal one, the information to be gained was doubtful and the risk definite, owing to the necessity of an anæsthetic and the presence of infection. It seemed preferable to explore the probable side—the right—and if a single kidney were found, to cut down on the other kidney.

OPERATION (April 7, 1926).—Anæsthetic: nitrous oxide and oxygen with local infiltration with novocain. The right kidney was exposed by Kelly's method through the superior lumbar triangle, the only muscle cut being the latissimus dorsi. From the upper pole near the summit a dilated and very tortuous ureter coursed downwards; it was fully 1½ cm. in diameter (*Figs.* 176, 177). The lower pole formed the great bulk of the kidney and was separated by a slight furrow posteriorly from the upper pole. From its pelvis issued a normal and undilated ureter. The capsule of the lower part of the kidney was thickened and adherent in parts, and the cortex showed the typical scarring of infection. There seemed to be no definite separate blood-supply for the upper part of the organ, the renal artery entering about the junction of the two parts. The upper pole was removed and the raw area oversewn.

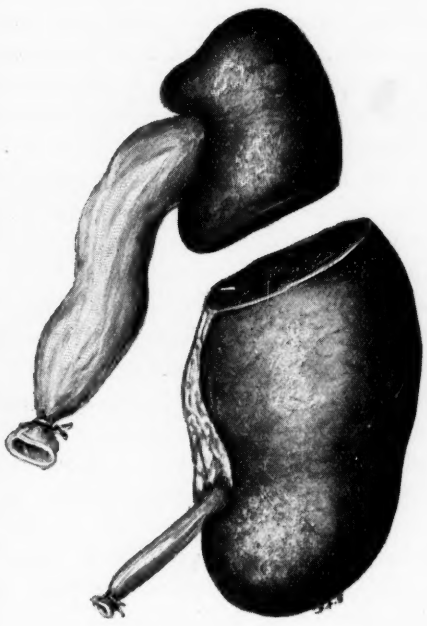

FIG. 176.—Sketch of the two segments of the right kidney removed separately. Note the widely dilated ureter of the upper portion.

FIG. 177. — Section of the kidney. Note absence of extra-renal pelvis in both portions.

At this stage there appeared to be some interference with the blood-supply of the remainder, and as it showed such definite signs of infection it was thought unwise to leave it, so that the net result of the operation was total nephrectomy. The ureters were resected as far down as possible without enlarging the incision, and the wound was closed, leaving a small rubber-dam drain.

SUBSEQUENT PROGRESS.—There was some leakage for a few days following the operation owing to fluid remaining in the dilated ureter left behind. On the seventh day and for a short time after some pus came through the urethra from the same source. The patient was discharged on the sixteenth day and has had no leakage since. There is still, at the time of writing (Oct. 27, 1926), an occasional slight discharge of pus.

The case illustrates most of the important features of incontinence of renal origin now to be more fully discussed.

ETIOLOGY.

This form of incontinence is due as a rule to one component of a double ureter, more rarely to a solitary ureter, debouching abnormally into the urethra or the vestibule of the vagina. The condition is due to irregular development of the renal bud derived from the lower part of the Wolffian duct. To follow the origin of the variation it is necessary to consider the developmental processes involved in the formation of the bladder, urethra, and the vestibule of the vagina. Formerly it was supposed that the bladder arose from the allantois, with the exception of the trigone, which was said to be derived from the cloaca. It seems to be definitely established now that the upper part of the bladder and the urachus are derived from the ventral cloaca, while the trigone, urethra, and vestibule are in large measure Wolffian in origin. The work of W. Felix in particular has served to give prominence to the latter view, and it appears to be impossible to explain the ureteral anomalies under review on any other supposition.

In the four-weeks fœtus the Wolffian duct opens into the ventral cloaca latero-posteriorly. The renal bud—the future ureter—enters this duct from the dorsal aspect. Eventually the ureter will open into the bladder close to the site occupied at this stage by the Wolffian duct, while the latter will pass internal to it, to open as the vas deferens in the male into the distal part of the posterior urethra, or as Gaertner's duct into the vestibule of the vagina in the female. It has to be explained how this transposition occurs. A common description is that the ureter comes to open separately into the ventral cloaca, while the orifice of the Wolffian duct migrates downwards until it opens much lower down in the ventral cloaca. This migration of an orifice is difficult or impossible to conceive, and a simpler explanation seems to be available on the following lines.

Felix has shown that the lower ends of the Wolffian ducts from the fourth week onwards expand more and more—trumpet-fashion—so that they form two extensive horns whose cavities are quite indistinguishable from that of the ventral cloaca which they enter; and that it is the expanded lower ends of these ducts, whose lips fuse behind in the middle line, that actually form the trigone of the bladder. The renal bud or ureter maintains its original position. The portion of the Wolffian duct, however, from which it arose is now actually itself part of the bladder. Instead, therefore, of the ureter being transferred from the duct to the ventral cloaca, it still opens into the original structure which has itself now expanded to form the trigone.

The further development of the Wolffian duct appears to take place along the following lines. Its original lower edge is fixed and incorporated as part of the future bladder at the upper margin of the trigone. As the duct lengthens, the loop of it passes down internal to the young ureter in a downward direction, more and more of its walls expanding and being taken up to form successively the urethra and the vestibule of the vagina. Its downward progress being eventually stayed, it remains in position as Gaertner's duct in the female or the vas deferens in the male. Naturally the expansion of the duct is not uniform, the bladder and urethra being formed more at the expense of the lateral and anterior walls than of the

posterior. Any structures attached to it will remain in the same relative position during the descent. This is notably true of the renal bud and its product, the ureter. If the renal bud is implanted low down in the duct before the beginning of descent, it will open early into the bladder and accordingly be situated high up. The further it is from the lower end in the beginning, the longer it will have to wait before the section to which it is attached expands to form the urinary tract. It may be placed so high that the descent of the Wolffian duct has ceased before the part to which it is attached is used in the formation of the vestibule and urethra. In

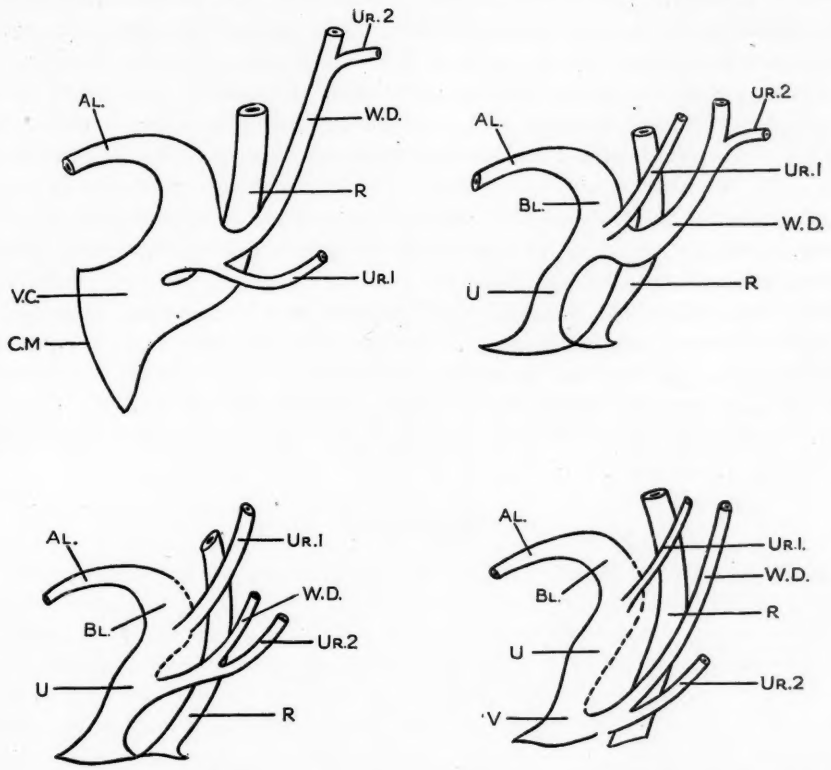

FIG. 178.—Diagrams illustrating the process by which the upper ureter comes to open in the urethra or vestibule. The dotted line indicates the portion of bladder, urethra, and vestibule formed from the Wolffian duct. A.L, Allantois ; V.C, Ventral cloaca ; C.M, Cloacal membrane ; Ur. 1, The lower ureter : Ur. 2, The upper ureter ; R, Rectum ; W.D, Wolffian duct ; U, The future urethra ; V, The future vestibule.

such a case the functioning ureter would still open into the unexpanded portion—namely, Gaertner's duct—and the adult condition would be a patent Gaertner's duct from which urine flowed owing to the entry into it of the aberrant ureter. Any cystoscopist of experience must have observed ureters opening in a descending scale from above and external to the trigone right to the neighbourhood of the bladder neck. More rarely they open still further down—in the urethra itself or the vestibule of the vagina. In the latter case it is not easy to determine whether it is the actual ureter which debouches in the vestibule, or a Gaertner's duct kept patent by the discharge into it of

a ureter which has never reached the lower urinary tract at all. Indeed, as the majority of cases of incontinence of renal origin are due to fistulæ in the vestibule, it is probable that the latter is the real condition. It is hard to conceive that in such a large number of cases the ureter itself would end exactly at this point.

In the case of twin ureters there are two renal buds arising from the same Wolffian duct. Commonly these lie very close together, so that the resulting ureteric orifices are adjacent in the bladder. In exceptional cases one bud develops much higher up than the other and gives rise to the upper pole of the double kidney. The ureter corresponding to the lower bud may open into the bladder in the normal situation, while the other does not reach the urinary tract till much later, and therefore its orifice is lower and may be in the urethra, vestibule, or even Gaertner's duct (*Fig.* 178). In some instances both ureteric orifices are lower than usual, and this fact has some value for diagnosis. If one of the two meatus seen cystoscopically is nearer to the neck of the bladder than the other, the former indicates the side of the aberrant ureter. It is inevitable on developmental grounds, and has always been borne out by experience, that a ureter opening extravesically belongs to the upper pole of the double kidney.

Bousquet, Schrader, Fleury, and Thilow (Case 2) have all recorded cases of complete absence of the bladder. In the first two the ureters opened into the urethra; in the last two into the vestibule. These can be explained only by the lack of expansion of the Wolffian ducts and their early fusion and descent, so that in one case they formed only the urethra and vestibule, and in the other the vestibule alone.

HISTORY.

As early as 1674 Schrader conducted an autopsy on a young girl in whom he found complete absence of the bladder with both ureters opening into the vestibule. Depaul, in 1852, reported a case in which, among other gross abnormalities, the right ureter entered one half of a double vagina in a non-viable fœtus. Fleury, in 1874, attempted to pass a catheter in a young girl who was incontinent. She died of peritonitis as the result, and at autopsy it was found that there was complete absence of the bladder with both ureters terminating in the urethra. The first writer, however, to give the anomaly a clinical interest appears to have been Baker, who, in 1879, published two cases of his own in both of which a truant ureter opened in the vestibule. The patients had both been incontinent from birth. One was completely cured by implanting the ureter into the bladder by the vaginal route. Massari reported a similar post-mortem case in the same year. With the advance of modern methods of investigation, it was realized that in the vast majority of cases the aberrant ureter was a component of a double ureter.

INCIDENCE.

The number of reports of cases has increased during the last ten years. Altogether 73 cases are recorded, excluding that of Lawson Tait referred to by Milton. Several writers have expressed the view that this does not

reflect the real incidence, as the possibility of the condition is not visualized by those handling cases of persistent incontinence. It seems difficult, for example, to believe that no instances have occurred in the practice of British surgeons at home or abroad, while a comparatively large number have been observed in Germany, France, and America. It is of interest that several surgeons—notably Baker, Albarran, Benckiser, Burnham, Furniss, Hunner, Judd, Rumpel, Thilow and Olshausen—have reported more than one example in their personal practices. The first case put them on the alert, and a similar condition was discovered by examining all cases of incontinence by the appropriate tests.

Sex and Age Incidence.—Cases of aberrant ureter causing incontinence occur exclusively in the female sex. Corresponding anomalies occurring in the male—the ureter opening into the prostatic urethra, the vas deferens, or the seminal vesicle—are not accompanied by incontinence. The powerful external sphincter prevents this. The irritation may cause pollakiuria but never incontinence.

While the anomaly is developmental, the symptoms are not in all cases observed from birth. Where the ureter opens close to the internal sphincter, the tonicity of the latter sometimes serves to retain the urine—at the expense of renal dilatation—until the muscle is relaxed in normal micturition. In Erlach's case, for example, the incontinence, if present, was too slight to attract attention and the discovery was made at autopsy. As a rule the mother becomes aware of something wrong after the first year, but she usually ascribes it to a bad habit, and hopes that the child will 'grow out of it'.

PATHOLOGY.

This will be considered in regard to whether the aberrant ureter is supernumerary (an inaccurate term, but difficult to replace) or single; right- or left-sided; opening into the vestibule, urethra, or vagina; and to the state of the corresponding kidney as regards position, dilatation, or infection.

The cases of Bousquet, Fleury, Knöpfelmacher, Massari, Depaul, Palfyn, Schrader, and the second case of Thilow are excluded from the analysis. Some of them have been already referred to, and they all concern gross abnormalities of development in addition to the misplaced ureter. This leaves 66 recorded cases for study.

Ureter Single or Supernumerary.—Authentic cases of a truant single ureter are rare—8 in all. Those of Alglave and Papin, Secheyron, Pieri, and the first cases of Judd and Thilow were definitely proved at operation or autopsy; those of Westhoff and Olshausen (Case 1) by satisfactory cystoscopic evidence. The eighth (Schroeder) is vouched for by Papin, the original report not being available.

In 42 cases the ureter was supernumerary as proved by autopsy, operation, or cystoscopy. In four of these (Alsberg, Conitzer, Obici, and Stammler) there were double ureters on both sides, two from one side terminating normally in the bladder. In 16 cases examination was not carried out to determine this point, but a close study indicates that probably all, or most of them, dealt with supernumerary ureters.

Ureter Right- or Left-sided.—Of the single ureters, 5 were on the right side, 3 on the left. Of the remaining 58 cases, 18 were on the right, 14 on the left, and 27 not stated.

Site of Termination.—

Single Ureters.—Five terminated in the vestibule, 3 in the urethra.

Supernumerary or Doubtful.—Forty-five ended in the vestibule, 12 in the urethra, and in 1 (Furniss's second case) the orifice could not be located.

There were no certain cases in which, apart from other gross abnormalities, two supernumerary aberrant ureters were present, though possibly Madelung's may have been of this nature. These figures may be summed up in tabular form as follows :—

	Cases	Per cent (approximate)
Description—		
Supernumerary	42	63
Probably supernumerary ..	16	26
Single	7	10
Probably single	1	1
	66	
Termination—		
Vestibule	50	75
Urethra	15	24
Not found	1	1
	66	
Side—		
Right	23	35
Left	16	24
Not known	27	41
	66	

The table shows that supernumerary aberrant ureters occur nine times as frequently as single ones; that the termination is nearly four times as often in the vestibule as in the urethra; and on the right side more commonly than the left. In those cases where the orifice is in the urethra, a very large proportion occur on the right side (right ureters, 12; left ureters, 4).

In many of the reports it is stated that the ending was in the vagina but it is clear that the vestibule of the vagina was really referred to. The developmental distinction between the two structures must be borne in mind. The vestibule includes a triangular area whose apex is at the junction of the two frenula clitoridis, whose lateral boundaries are the medial margins of the labia minora, and whose base is the line of insertion of the hymen. All this area and the external surface of the hymen itself is developed in part from the ventral cloaca, but chiefly from the expanded Wolffian ducts. The process by which an aberrant ureter can terminate here is exactly the same as if it ended in the urethra, and has been discussed under etiology (p. 233).

The vagina itself, however, is of Müllerian origin, and it would require a much more severe developmental wrench for a ureter to leave its Wolffian attachment and open into the Müllerian system. This certainly occurs, but only where other gross abnormalities accompany it, such as exstrophy of the bladder, persistent cloaca, double vagina and uterus, fused single kidney, atresia ani, or opening of the intestine and bladder in the abdominal wall.

These gross malformations are not very uncommon, especially in the non-viable fœtus, and only a very small proportion are dissected and reported on. In them the whole mechanism by which the cloaca, Wolffian, and Müllerian systems become organized to form the rectum, urinary, and genital systems has run riot, and almost any combination may be reproduced. The cases of Depaul, Palfyn, and Knöpfelmacher are of this type, and I have observed a similar condition in a child who died on the seventh day.

Papin carefully investigated all clinical cases in which it was stated that the truant ureter opened into the vagina, and concluded that in each it was really the vestibule that was meant. These cases were all in adult women, where the hymen had disappeared, and the distinction between the vestibule and the anterior vaginal wall was not easy to make. In Wulff's case the orifice was said to be in the labium minus, but he probably refers to the base of that structure, which is developmentally the extreme outward limit of the vestibule.

Condition of the Ureter.—In every case with one exception (Hohmeier) the ureter was dilated, and in many there were strictures at various points in addition to the narrowing at the external orifice. Hydro-ureter, and in some cases pyo-ureter, may thus be considered the practically universal rule. The cause is found in the very narrow termination, which is usually so small as to be difficult to find, and has to be slit or dilated in order to admit even a small-bore catheter. Immediately proximal to the external orifice, there is usually a cystic dilatation which may be palpated from the vagina. In Hohmeier's case there was a calculus impacted at the lower end of the abnormal ureter.

Nature of the External Orifice.—If this is in the urethra, it may appear urethroscopically to be of similar form to the normal type seen in the bladder. Sometimes it is protected by a valve or fold of mucous membrane, and this may be felt to check the passage of a catheter or cystoscope. In the vestibule the opening is as a rule very close to the external urethral meatus, but may be half an inch from it to one side above or below. In a parous woman in whom the hymen is absent it may be so far posterior as to appear to be in the vaginal wall. In a few of the reported instances (Hohmeier, Olshausen) it was wide and slit-like, in most it was punctiform, in a few (Albarran, Westhoff) cribriform. Usually it was concealed by a fold of mucous membrane, making it difficult to locate. If it lies slightly to the right or left side, the ureter belongs to that side of the body.

Condition of the Corresponding Kidney.—In one of the cases accompanied by other abnormalities there was a fused single kidney, with two ureters—one aberrant; in the others two kidneys, both single, both double, or one single and one double. Where the ureter arises from a double kidney it invariably belongs to the upper pole. The double kidney is of the common type, one portion being larger and richer in function than the other, the two being separated by a ridge, more or less marked. While the ureter is widely dilated, there is not always a corresponding dilatation of the pelvis of the partial kidney—in fact, not infrequently there is no properly defined pelvis at all. Hydronephrosis, however, is common, and sometimes (Rumpel, Alglave, and Papin) there is pyonephrosis.

Presence of Infection.—The study of this feature is of importance in considering the correct treatment. It is not clearly indicated in many reports, but in 15 infection was definitely ascertained to be present, while in only 7 was the urine proved to be sterile. The younger the patient, the more chance of the absence of infection, but in the case reported here it appeared to have set in during the third year of life.

Function of the Affected Kidney or Half-kidney.—As nephrectomy or partial nephrectomy will be the operation of choice in many cases, great stress should be laid on this point. Full reports are available in five of the cases of single kidney. Alglave and Papin found a completely destroyed and pyonephrotic kidney with no function, Pieri one suppurating and practically functionless. In the cases of Olshausen and Westhoff the normal organ was doing practically all the work. In that of Judd the ureter was transplanted, and after much treatment was eventually able to function half as well as its fellow.

In practically every case where the ureter was supernumerary, the function, as shown by the quantity of urine and dye tests, was insignificant as compared with the opposite side or the other portion of the kidney on the same side. This indicated a comparatively small upper section of the double kidney or one destroyed by dilatation and infection.

SYMPTOMATOLOGY.

Diurnal and nocturnal incontinence, side by side with regular normal micturitions, is the characteristic symptom. The leakage is always worse in the day and is more or less continuous; it may only amount to slight staining of the sheet at night. In cases where the abnormal orifice is close to the bladder sphincter in the urethra, incontinence may be noticed only after some event such as child-birth which has weakened the sphincteric control. Kolisko had a case of this nature in a woman of 21, in which there was no history of incontinence at all. The widely dilated ureter may act as a reservoir, so that the incontinence is intermittent and may occur on coughing or straining. It is almost characteristic that some days may be passed in which the patient is practically dry. This is always followed by a period in which the incontinence is worse. Pain may be felt in the corresponding kidney or along the line of the ureter, but this is rare even in moderately infected cases. Gross infection with pus formation may cause the urinary leak to be replaced by a discharge of pus, and be accompanied by severe pain of a constant or intermittent nature over the ureter or kidney. Tenderness may be elicited in the same region in cases of less severity. There is frequently inflammation and excoriation about the vulva owing to the constant wetting. By vaginal examination a cystic swelling or thickening may be felt in the line of the ureter. The general health is excellent unless sepsis is advanced.

DIAGNOSIS.

This embraces the *fact* of aberrant ureter, the side to which it belongs, whether it is supernumerary or single, the presence of infection or dilatation of the ureter, and the functional value of the renal element involved.

If the history is of incontinence with normal micturition, and urine is seen to drip away from the vestibule or urethra after the bladder has been emptied with a catheter, the diagnosis of aberrant ureter is almost certain. The rhythm of the drip is similar to that from a ureter draining through a ureteral catheter. When the bladder is filled with a coloured solution—indigo-carmine or methylene blue—the urine dripping away remains clear. In some cases it may be necessary to make repeated examinations before the leak is observed

A striking feature is the difficulty in locating the abnormal orifice even when it is known to be present. Painstaking examination with the help of a magnifying lens in order to find the opening in the vestibule may be necessary, while if it is in the urethra a water-dilating urethroscope may disclose it in the adult. In young children it will usually be impossible to do this, on account of the small urethra and the difficulty in getting sufficient dilatation.

There should be no difficulty in differentiating the ordinary type of enuresis in which there is copious bed-wetting after which the bladder is empty. In aberrant ureter the function of micturition is normal, though there may be frequency from concurrent infection. There is, however, a class of cases of diurnal incontinence in children where, through weakness of the bladder musculature owing to infection or other cause, a small quantity of urine escapes on exertion. The symptom does not as a rule begin till after the age of 6. The patients should be closely observed, preferably in hospital. Methylene blue is given by the mouth to keep the urine coloured, and filter paper covered with a gauze swab is placed on the vulva so that the smallest leakage may be observed. If after a week of observation in the recumbent position there is no staining, aberrant ureter can probably be excluded.

In adult cases where incontinence takes place only on coughing or exertion, the diagnosis may be very difficult, as the same symptoms frequently occur through weakening of the vesical sphincter. In these and in cases of vesicovaginal fistula the history should lead to thorough urological examination. The vagina can be satisfactorily examined by the urethroscope in the youngest child. The cystic ureter may be palpated through the anterior wall of the vagina, and urine may be expressed from it.

Site of the Ureter and whether Supernumerary or Single.—Where the orifice is in the vestibule and lies to one side of the middle line, the ureter belongs to that side. If it is in the middle line, its course may be traced by dilating the orifice and inserting a sound. Palpation through the anterior vaginal wall will disclose the sound deviating to one side as it ascends. This also indicates the side of the ureter. As the great majority of cases are of supernumerary ureter, the cystoscope will reveal two apparently normal ureteric orifices in the bladder. If these are not symmetrical in position, the least normal will probably belong to the double kidney. In the case reported above, the ureteric orifice of the abnormal side was nearer to the neck of the bladder and narrower in bore than the other.

If an opaque catheter can be inserted into the supernumerary opening, the exact nature of the ureter and its kidney may be studied urographically. The insertion of the catheter as far as the pelvis is not, however, always possible, on account of the strictured and tortuous ureter, and it may not be

considered advisable to take a ureterogram owing to the difficulty in recovering the opaque fluid.

If the ureter opens in the urethra, similar methods may be available in the adult. In the infant or young child they are rarely practicable. Double pyelography with catheters in both normal ureters is dangerous, and might give results very difficult to interpret. Plain X rays will rarely give useful information. If the two kidney shadows are well shown, the one that is largest and whose notch is not in the centre is probably the double organ.

Closing the visible orifice to produce pain in the corresponding side is a diagnostic measure belonging to pre-radiographic days.

Infection.—The presence of infection can be ascertained by the offensive smell of the discharge, or by examination of urine recovered through a ureteral catheter if one can be inserted.

Function of the Corresponding Kidney or Half-kidney.—In the adult exact function tests may be carried out by the insertion of three catheters and the study of the separate urines and dye elimination. In the infant the most convenient test is to inject 10 c.c. of indigo-carmine intramuscularly before the examination. In children of 5 or more it is easy to inject the dye into the median basilic vein. The orifices in the bladder are then observed with the cystoscope. If the dye is seen to appear in good concentration and strong efflux from each ureter in the bladder in the case of double kidney, or from the single orifice in other cases, while the urine leaking away is hardly coloured, it may be concluded that the kidney or part-kidney supplying the leak is small or hydronephrotic. If a large proportion of the urine is coming from the leak, and this becomes blue-coloured at the same time as the dye appears in the bladder, the appropriate kidney has considerable function, and efforts should be made for its preservation.

PROGNOSIS.

Spontaneous cure is almost impossible. In the cases of Kolisko and Secheyron the external orifice appears to have been so minute as to have closed spontaneously with atrophy of the kidney. The outlook as regards life is dependent on the rapidity of onset and severity of infective changes. Apart from these the condition does not shorten life. The state of untreated patients, however, is miserable in the extreme, and the mental effect deplorable. The result of surgical treatment is excellent.

TREATMENT.

In most instances the diagnosis has been a surprise, and each surgeon has carried out a procedure devised by himself. A table of the typical operative procedures is given in the article by Furniss, to which reference may be made. In most of the early cases the ureter was ligatured either at the abnormal orifice or after dissecting it up from the vagina. The result in infected cases was severe reaction, followed by the breaking-down of the ligature and recurrence, and even death.

Low implantation into the bladder has the advantage that it is not necessary to ascertain the side of the ureter. It has not proved very satisfactory,

and the literature abundantly illustrates how frequently two, three, or four subsequent operations were required for the closure of vesicovaginal fistula and further treatment of the ureter.

Isolation of the ureter by abdominal operation and transplantation into the bladder is advocated by Judd as a conservative measure. His case was one of single kidney, and after repeated treatments by pelvic lavage to control infection, the transplanted kidney only attained to half the function of the other.

It is to be hoped that with better diagnosis the operation will be performed on young children, and the correct therapy must be considered from this point of view.

The proper procedure depends on: (1) The presence or absence of infection: (2) The relative function of the kidney or portion of the kidney concerned; and (3) The soundness of the remaining kidney. The usual type of case is one in which the kidney has little function, the ureter is dilated and possibly strictured, and infection is present. In these the only logical treatment is partial nephrectomy with or without the removal of the ureter at the same sitting. It is a simpler operation than implantation by abdominal section, and it removes a practically useless organ, eliminates a focus of infection, and cures the incontinence at the same time, without causing cystitis by introducing sepsis into the bladder. The question of the simultaneous removal of the ureter is governed by exactly the same factors as would lead to its removal in cases of nephrectomy where it ran a normal course. In most cases it should take up and cause no further trouble. It may, if widely dilated and infected, continue to cause an intermittent pus discharge through its lower end. Papin, after partial nephrectomy, had to operate again to drain the dilated lower part of the ureter into the vagina.

Where the escaping urine has been proved to be absolutely sterile and the function of the abnormal portion of the kidney is small, simple obliteration or ligature of the ureter may cause the appropriate kidney substance to undergo quiet atrophy. The procedure is almost a minor operation—dissecting the lowest portion of the urethra through the anterior vaginal wall, and ligaturing after resection of the lower end. If there is severe reaction, a second operation on the kidney and ureter from above may be necessary. Hunner resected the whole length of the ureter in a girl of 12, leaving the kidney untouched, and the case did well.

In those rare cases where the kidney belonging to the aberrant ureter is performing a considerable share of the total renal function, some form of implantation is advisable. This can be done most successfully by high extraperitoneal approach.

In the overwhelming majority, however, partial nephrectomy is the operation of choice. The most probable side having been determined, the kidney is exposed by the Kelly method through the superior lumbar triangle. The double nature of the organ will be quickly recognized. Should the case be one of supernumerary ureter and the exposed kidney be single, a mistake has been made, and the wound should be stitched up and the other kidney cut down upon. As a rule, there is a ridge or marking to show the limitation of the upper pole which is the part to be excised. The pedicle having been

temporarily controlled, the organ should be cut across at the level of the ridge. A wedge-shaped portion is then removed at the expense of the remaining part of the organ so that the edges may be brought together. Hæmostasis should be secured by this means alone, as the ligature of any of the vessels entering the kidney may endanger the blood-supply of the part that it is wished to leave. The upper ureter should be cut across as low down as convenient without enlarging the incision.

If the walls of the ureter are greatly thickened and the lumen is full of purulent urine, the whole ureter should be excised by making a separate muscle-splitting incision lower down. The operative mortality should be practically nil.

SUMMARY.

1. There is a rare type of urinary incontinence caused by an aberrant ureter opening into the urethra or the vestibule of the vagina.

2. The cardinal symptom is incontinence side by side with normal urinary function.

3. The abnormality is explicable only by presupposing that the Wolffian ducts enter into the formation of the female urethra and vestibule.

4. Usually the abnormal ureter is one component of a double ureter, so that cystoscopy reveals two normal ureters in the bladder.

5. The ureter is generally dilated and infected and belongs to a kidney which is diseased and has little function.

6. The usual treatment should be nephrectomy or partial nephrectomy, but in clean cases ligature of the ureter may suffice. If the kidney is performing a large share of the renal function, the aberrant ureter should be implanted into the bladder by high operation.

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THE RELATION OF TUBERCULOSIS TO KÖHLER'S DISEASE.

By H. H. GREENWOOD,

HON. SURGEON, VICTORIA HOSPITAL, SWINDON.

Some four years ago[1] I advanced evidence and arguments in an attempt to show that Köhler's disease is due to a blood-borne infection of the tarsal scaphoid setting up an osteomyelitis. The balance of evidence indicated the *B. tuberculosis* as the causative organism. An undoubted case of the disease was described; in the skiagram a tiny sequestrum could be discerned separated from and lying loose in the soft tissues near to a corresponding hollow in the scaphoid bone of the right foot. Complete recovery ensued without any breach in the continuity of the skin; this has happened in every case hitherto recorded, so that no opportunity of investigating the histological condition of the affected tissues had, at that time, arisen. The boy's parents suffered from tuberculosis of the lungs, and he himself afterwards developed phthisis. The deduction that the offending organism was the *B. tuberculosis* could claim, at last, a reasonable degree of probability.

By a different path Fassett[2] in 1914 had arrived at a similar conclusion. More recently Lawford Knaggs[3] described Köhler's disease as tarsal scaphoiditis, assuming thereby an inflammatory origin. He says, "It is probable that serous osteomyelitis is also responsible for the condition", and again, "It is very likely to be mistaken for tuberculous disease". These statements indicate an approach to a more precise pathological conception, and to a discarding of the various recondite, but largely speculative, theories that have cumbered for so long the orthodox teaching on the disease. The term 'serous osteomyelitis' is descriptive and carries implications—the production of a fluid serous exudate free from the gross characteristics of pus, by an inflammation due to pathogenic organisms or to their toxins. It is still confidently reiterated that the disease always ends in complete recovery.

The scaphoid of the foot, small bone though it be, is yet the keystone of the arch. In the architecture of the foot it is the most prominent of all the tarsal bones, more exposed to trauma, subjected to strains and pressure at every step. Even a mild osteomyelitis there is likely to cause pain and a limping gait in a child at an early stage, commanding treatment by rest. There is small wonder, therefore, that complete recovery without abscess formation should occur in most cases.

Tuberculous disease of the ankle-joint is so subtle in onset that, as a rule, little can be ascertained about its true genesis. Beginning usually in the astragalus or os calcis, less commonly in the cuboid, the disease is often overlooked at its inception, only challenging observation when the process has already spread to neighbouring bones. In a young adult (Miss J., age 17 years) now under observation tuberculous disease is seen plainly (in a

radiograph taken four months ago) to be confined to the scaphoid and cuboid; this was at the earliest onset of acknowledged symptoms; now the whole tarsus is involved and no indication remains as to the primary focus. If the disease should begin in the scaphoid, pain would be more likely to compel recognition at a stage earlier than would obtain if it began in either astragalus or cuboid.

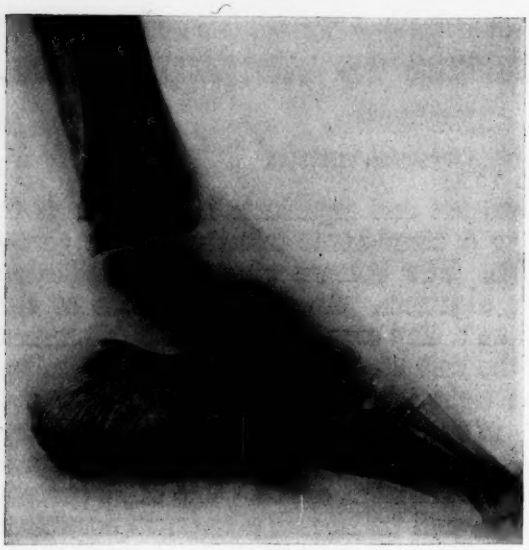

FIG. 179.—Right foot.

The case detailed below may serve to crystallize our conception of tarsal scaphoiditis, since an opportunity has now occurred of following the disease from its earliest stage to a disastrous conclusion, and of investigating microscopically its pathology.

Oliver T., age 3½ years, without any known history of previous injury, began to limp in the right leg. A tender, painful swelling on the arch of the right foot was noticed by his parents. He was taken to Dr. Evans, who referred him to me on July 20, 1925. The boy's general health was poor, but he was free from pyrexia or any sign of disease other than the local condition. The physical signs were typical, a tender, slightly painful swelling over the scaphoid of the right foot, without redness or œdema, and causing a well-marked limp in walking.

On July 22, 1925, Dr. Harrison Orton X-rayed the feet and reported: "From a comparison of these you will see that the scaphoid is denser and smaller on the right side than it is on the left, and I think there is no doubt this is a case of Köhler's disease." (*Figs.* 179, 180.)

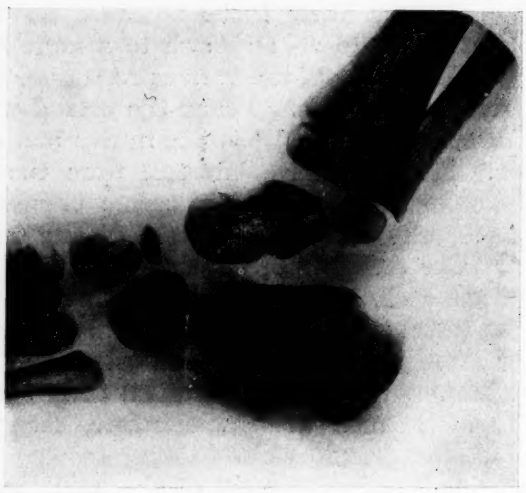

FIG. 180.—Left foot.

The foot and leg were put up in plaster-of-Paris, but five weeks later this was removed on account of pain. The swelling over the scaphoid, however, became larger, slight reddening of the skin covering it appeared, and fluctuation could be felt. On Sept. 26 aspiration with a fine

needle yielded pus, on which Dr. Knyvett Gordon reported: "In stained films of the pus no tubercle bacilli were found. By cultivation of the specimen pneumococci have been isolated."

The whole ankle-joint now became swollen; the patient was admitted to hospital on Oct. 10, and on Nov. 10 free incisions became necessary (*Fig.* 181, A and B). A small portion of the soft tissues over the scaphoid was excised and was "found to consist of granulation tissue of pyogenic origin, there being no evidence of tuberculous or malignant disease."

FIG. 181.

FIG. 182.

By Nov. 21 the disease had made further progress; a new sinus (*Fig.* 182, C) had appeared; a radiograph showed rarefaction of the tarsal bones and definite necrosis of the astragalus (*Figs.* 183, 184). On Dec. 3

FIG. 183.

the pus showed "no tubercle bacilli, but many Gram-positive cocci were present. By cultivation *Staphylococcus aureus* has been isolated."

Despite open-air treatment and further free incisions (Jan. 22, 1926) the condition did not improve. Hitherto the disease had remained localized to

the neighbourhood of the ankle-joint, but now more fresh foci of infection appeared (*Fig.* 185, C) and amputation became necessary. This was done through the lower third of the leg on Aug. 1. Rapid healing and rapid

FIG. 184.

improvement in general health followed, and the patient was discharged from hospital on Sept. 26.

The report by A. Knyvett Gordon on the portion of limb removed is interesting: "Section from os calcis in a state of necrosis and infiltrated with gelatinous granulation tissue. There was a similar cavity in the scaphoid with a loose sequestrum. This section shows infiltration with typical tuberculous granulation tissue with secondary pyogenic infection."

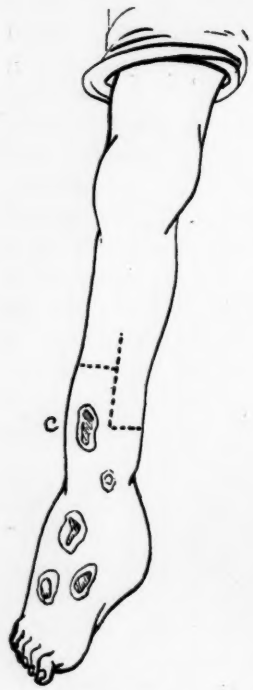

FIG. 185.

There is general agreement that a diagnosis of Köhler's disease is justified if the following criteria obtain: (1) The affected bone is smaller than normal; (2) The outline of the bone is irregular; (3) The density of the bone is increased; (4) The architecture of the bony trabeculæ has disappeared; (5) The general shape of the scaphoid is altered, being flattened from before back and not widened from side to side.

The case under consideration fulfils these conditions, and there seems no doubt that when first observed a diagnosis of Köhler's disease was justifiable. The terminal condition was 'beyond a peradventure' one of tuberculosis of the tarsus. In the early stage the presence of an infective organism (pneumococcus) was demonstrated before breach of continuity of the skin allowed any avenue of approach for the organism other than by the blood-stream.

It would seem reasonable to deduce that the primary infection was by the *B. tuberculosis*, accompanied by the less persistent pneumococcus; and that, in effect, the *B. tuberculosis* produced a condition indistinguishable, either by clinical

signs and symptoms or by X-ray demonstration, from the classical entity known as Köhler's disease.

CONCLUSIONS.

1. There are good reasons, already given, why tarsal scaphoiditis should almost invariably result in a *restitutio ad integram*; the pathology of the condition thereby has lacked the ultimate proof of histological examination.

2. The foregoing case leaves little doubt that the disease is due to a blood-borne infection of low pathogenicity—in this instance the pneumococcus, followed later by the *Staphylococcus aureus* (which must be regarded as being due to accidental contamination).

3. The supervention of tuberculosis, which rendered amputation necessary, finds its parallel in the lungs, where *B. tuberculosis* not infrequently follows the pneumococcus. It may be that the infection was, from the onset, a dual one, the *B. tuberculosis* only becoming dominant in the later stages; but the problem of symbiosis is foreign to the purpose of this paper, which is to establish the reality of infection by a definite organism as the real cause of the disease.

4. The term 'tarsal scaphoiditis' is in accordance with the known pathology of the disease. The term 'Köhler's disease' has been applied to an early and abortive infection of the tarsal scaphoid by the *B. tuberculosis*.

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A NEW METHOD FOR THE RAPID MICROSCOPICAL DIAGNOSIS OF TUMOURS: WITH AN ACCOUNT OF 200 CASES SO EXAMINED.

By LEONARD S. DUDGEON, C.M.G., C.B.E.,
PROFESSOR OF PATHOLOGY, UNIVERSITY OF LONDON.

AND C. VINCENT PATRICK,
RESIDENT ASSISTANT SURGEON, ST. THOMAS'S HOSPITAL, LONDON.

Various methods have from time to time been introduced for the rapid microscopical examination of new growths and inflammatory tissues removed at operation, but on the whole the results have not been satisfactory, owing to the imperfect preparations obtained in the short space of time allowed. The late Professor S. G. Shattock, to whom English surgeons of experience referred for a final opinion on the microscopical examination of new growths, was strongly opposed to methods of rapid diagnosis, owing to errors dependent upon the technique and the short time available for microscopical examination. Dr. E. H. Shaw[1], however, has done much work on the perfecting of a method for the rapid diagnosis of new growths, and in his hands the results obtained have been very successful.

It occurred to us that as perfect preparations of intestinal parasites are obtained when films of intestinal mucus or fæces are fixed *in the wet* in Schaudinn's fluid, it might be possible to employ this method for the examination of new growths. Dudgeon and Jewesbury[2] used Schaudinn's solution for the cytological examination of human milk, and as a result obtained beautiful preparations of the various cells. In our hands wet films of new growths and inflammatory tissues removed at operation have given a rapid and easily workable technical method. The results of the first 200 consecutive specimens studied by this method, upon which this paper is based, have been very successful, as judged by the control examination of sections of the same tissue prepared in paraffin by the usual technique.

Experience is required for this rapid method, as for all other laboratory methods, and it is essential to possess a sound knowledge of the microscopical study of new growths and inflammatory tissues by the usual technique. We consider that the advantages of the method are the beautiful preparation of individual cells and fragments of tissue which are seen in the films, the simplicity of the technique, and the small amount of material required for the preparation of the films; all the necessary apparatus, with the exception of the microscope, can easily be carried in a portable case 12 in. by 8 in. by 3 in. Mistakes have occurred, but they are few in number, and only 6 out of 200 examinations were definitely serious errors. It is possible that in course of time, and with greater knowledge of this method, such mistakes will be less

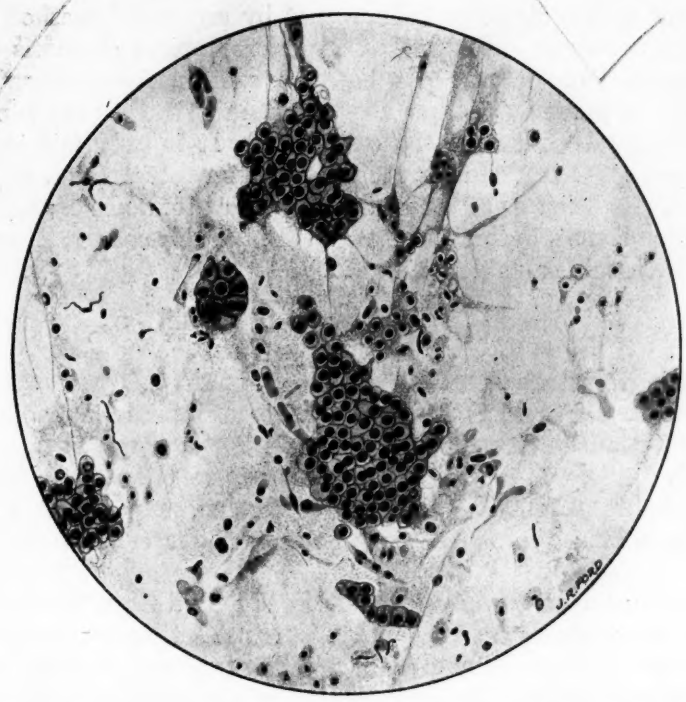

FIG. 186.—*Case* 175. Adenoma of prostate gland. Note clear outline and regularity in size of individual cells in the fragments of tissue, and the relative scarcity of isolated epithelial cells. (× 185.)

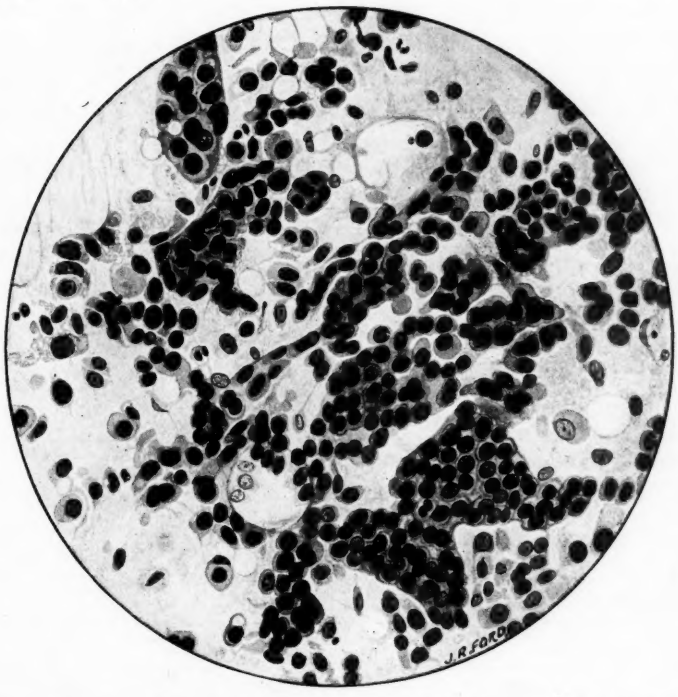

FIG. 187.—*Case* 115. Spheroidal-celled carcinoma of breast. Note large size of cells, plaques of cells, and the large number of isolated cells. (× 185.)

frequent; but it is difficult to believe that by any rapid method some errors will not occur, when we consider that the microscopical diagnosis of some new growths requires long periods of exhaustive examination. For these reasons we feel confident in recommending the wet-film method for the rapid diagnosis of new growths and inflammatory conditions. It is only fair to add that a correct diagnosis was made in the majority of instances without any knowledge of the clinical condition or of the macroscopical appearance of the new growth. It was considered that, in testing a new method of this nature, it was important to dispense with this valuable assistance.

TECHNIQUE.

The tumour or other tissue is cut into, and the freshly-cut surface scraped *firmly* with a sharp scalpel. The milky juice so obtained is spread evenly on slides and put immediately into Schaudinn's fluid *while still wet*. The composition of this fluid is as follows: (1) Saturated solution of mercuric chloride in distilled water, 2 parts; (2) Absolute alcohol, 1 part. A few drops of glacial acetic acid are added so as to obtain 4 per cent of the acid in the solution.

The wet films are allowed to remain in this fluid from two to ten minutes according to circumstances. If rapidity is essential, then an absolute minimum time of two minutes can be employed, but the best preparations are obtained by ten minutes' fixation. In some cases the wet films were placed in warm Schaudinn's fluid, but no advantage was obtained. Time will be saved if the tissue is scraped and the wet films are put into the fixative in the operating theatre, so that fixation will take place during transit from the operating theatre to the laboratory. The films are afterwards washed in spirit, and then in distilled water. Mayer's hæmalum is employed as the nuclear stain, and eosin as the counterstain. Dehydration and clearing are done with absolute

Table I.—**RESULTS OF TOTAL OF NUMBER OF CASES EXAMINED.**

Classification by Paraffin Sections	Number of Cases	Diagnoses made on Films		
		Correct as regards leading feature (e.g., malignancy)	Fully correct	Incorrect
Inflammatory	51			
1. Simple ..	43	42	36	1
2. Tuberculosis ..	7	7	6	0
3. Syphilis ..	1	1	0	0
Lymphadenoma ..	2	2	2	0
Neoplasms ..	143			
1. Simple ..	33	29	23	4
2. Carcinoma ..	89	86	83	3
3. Sarcoma ..	16	15	13	1
4. Endothelioma	5	5	4	0
Various	4	4	2	0
Total	200	191	169	9

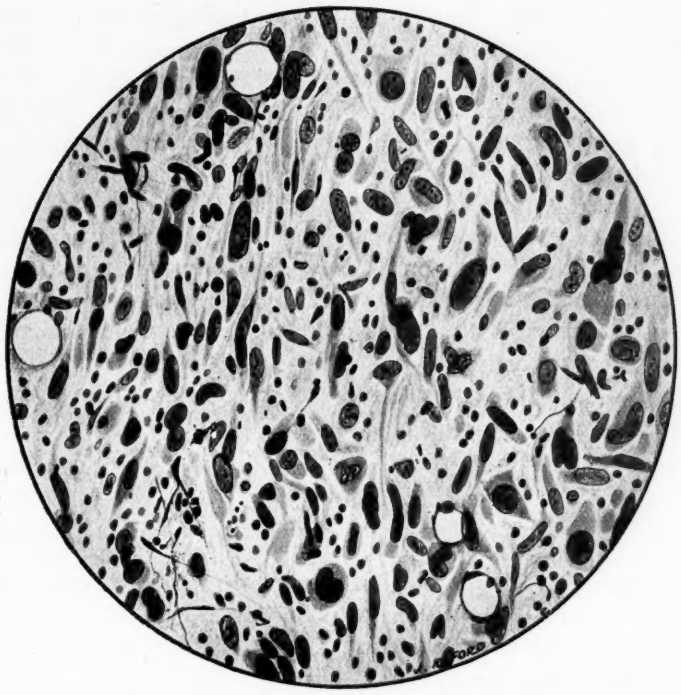

FIG. 188.—*Case* 90. Spindle-celled sarcoma of humerus. Note great variation in size of the tumour cells and their almost complete separation from each other. Many red blood-cells are present. (× 185.)

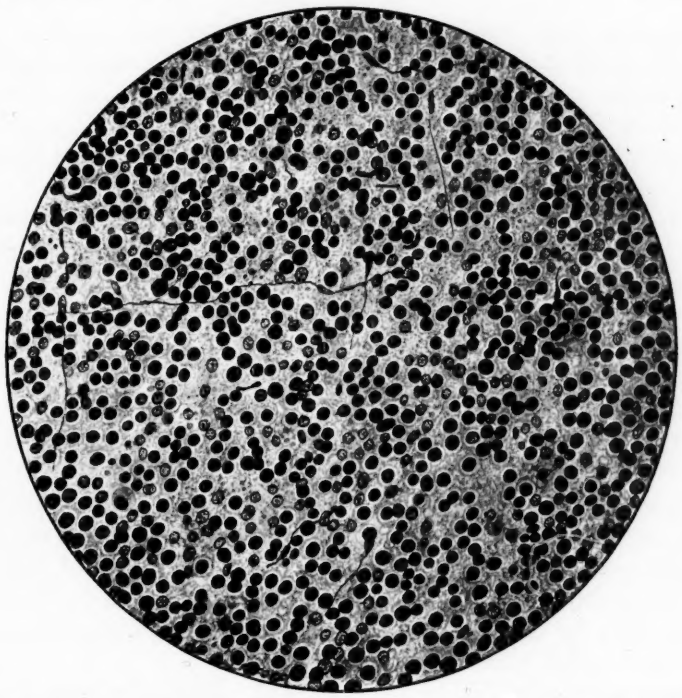

FIG. 189.—*Case* 184. Round-celled sarcoma of tonsil. Note the almost uniform distribution of round cells, which are larger and less deeply stained than lymphocytes. (× 185.)

alcohol and xylol, and the films are then coverslipped with Canada balsam. The total time required for the technical process can be as short as eight to ten minutes, but the time required for the microscopical examination is dependent upon the nature of the tissue and the rapidity of the investigator.

In *Table I* are shown the results of the first 200 consecutive cases examined by this method. Glands removed with a primary tumour and examined separately have not been included in this table, the microscopy of the primary tumour only being considered. It will be seen that in 169 of the 200 cases a definite and correct microscopical diagnosis was made on the Schaudinn films alone; and in 191 cases the diagnosis made was correct but incomplete; it being correctly stated in 22 cases whether the specimen was simple, malignant, or inflammatory, but the exact nature not being fully determined on the film alone. In some 15 cases the rapid microscopical report was awaited by the surgeon, and utilized to decide the course of the operation; in all these cases a correct diagnosis was returned.

ERRORS IN DIAGNOSIS.

Of the 9 erroneous diagnoses made on the films, 6 occurred in the first hundred examined, and 3 in the second hundred. In the third hundred, now under examination but not reported here, one mistake has so far been made. The 9 mistakes made were as follows:—

Two cases (39 and 73) were ulcers of the lower lip. One was a septic ulcer which was returned as carcinomatous owing to the presence of altered epithelium from the edge of the ulcer; and the other which was actually carcinomatous, was reported as 'no *definite* evidence of carcinoma'. In the films from both cases the inflammatory reaction was the most marked feature, but the scrapings were made from *ulcerated surfaces*. In later cases the scrapings have been made only from the *cut surface of the deeper tissue*, and a considerable series of ulcers from the mouth, tongue, and lip has since been examined without a mistake.

One case (81) was of a nodule stated to have been removed from the peritoneum. The film report reads: 'suggests normal intestinal mucosa', but in view of its alleged origin it was labelled 'columnar-celled carcinoma'. It proved to be the apex of a diverticulum from a case of diverticulitis, which had penetrated the bowel wall as far as the peritoneal coat. This possibility was not suggested by the operator's description of the specimen, and did not occur to us as a possible explanation at the time of the examination.

Two cases (32 and 176) were of lymphatic glands examined for secondary deposits of carcinoma. The scrapings showed no evidence of carcinoma, but sections, necessarily taken at a slightly different plane in the glands, showed a small islet of carcinoma in each case. This discrepancy might occur with two different paraffin sections taken at different depths in a gland, and is no criticism of the film method; the presence of a small deposit of growth in a gland can, of course, only be excluded by the examination of a considerable number of sections of the entire gland.

Four errors were made in breast tumours. One (114) was judged on the film to be 'an inflamed fibroma', but the section showed it to be a fibrosarcoma.

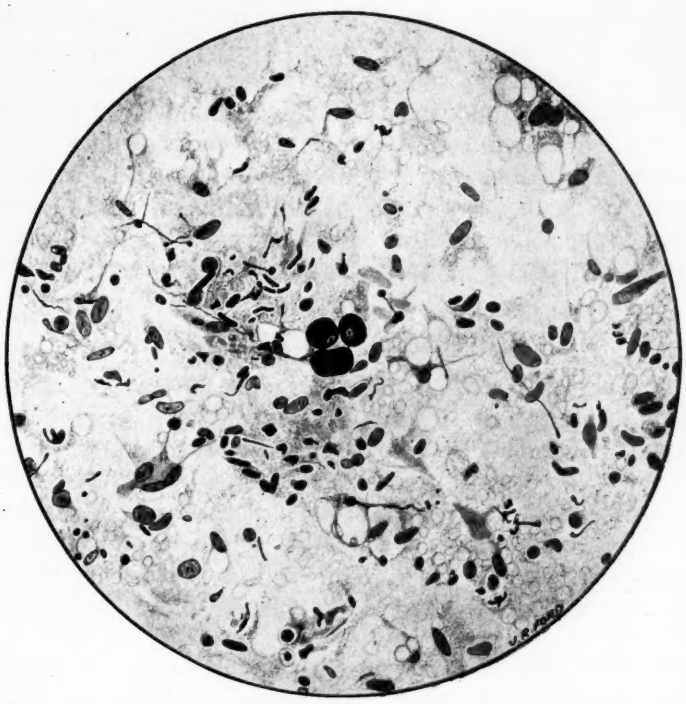

FIG. 190.—*Case* 154. Organizing hæmatoma. Note the presence of connective-tissue cells of various shapes and sizes. Three large cells in centre of picture contain blood pigment. (× 185.)

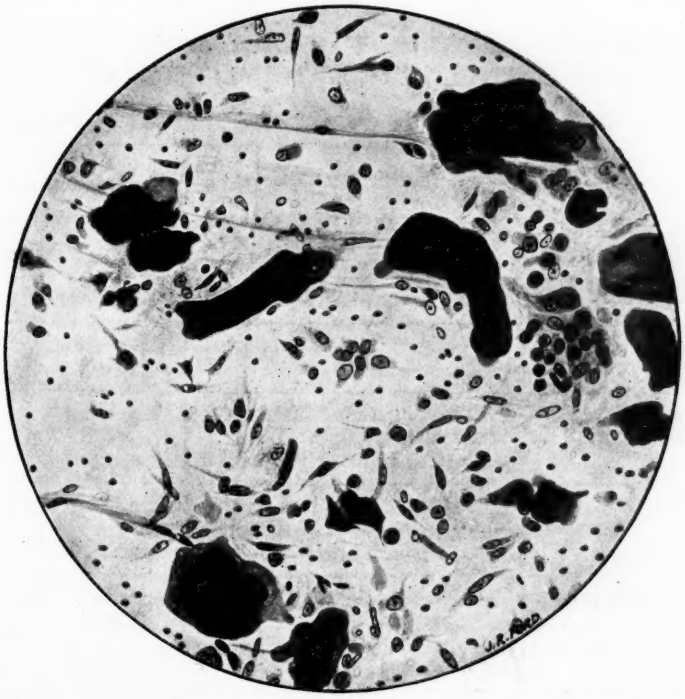

FIG. 191.—*Case* 93. Giant-celled sarcoma of fibula (myeloma). Note the very large multinucleated cells, and the scattered spindle cells of the stroma. (× 185.)

Clinical experience has shown that this error may occur even with the best paraffin sections. Two other breast cases (48 and 63) were fibro-adenomata examined early in the series; one was returned as 'atypical carcinoma', and the other as 'epithelial tumour, not distinguishable from carcinoma'. The last mistake, also a breast case (134), is the most serious. Films of the tumour show what appears to be a typical spheroidal-celled carcinoma, exactly similar to the large number of other breast carcinomata examined and reported on correctly, and quite unlike any films from simple tumours that we have made. The paraffin sections show a typical adenofibroma.

RESULTS IN DETAIL.

Table II shows the detailed results of the first 200 cases examined, arranged under the organ or system from which each specimen was obtained. It should be noted that the diagnosis made at operation was sometimes misleading in its indication: e.g., a 'cyst of neck' examined proved to be a breaking-down carcinomatous gland and has therefore been classified under section *G* of this table, and some cases of 'glands of the neck' proved on microscopy to belong to the salivary-gland section *D*. Where both a growth and the appropriate lymph glands were examined, the case is entered under both headings in this table.

The results of the connective-tissue and bone cases are given in full, as a sample of the actual results that may be expected by this method. The remaining groups of cases have been analysed, owing to the large amount of space that would be required to deal with the whole results in detail.

Table II.—**RESULTS ARRANGED IN GROUPS UNDER THE ORGANS OR SYSTEMS WHENCE THE SPECIMENS WERE OBTAINED.**

A. **CONNECTIVE TISSUES AND BONES** (18 *Cases*).

Case No.	Origin of Specimen	Section Diagnosis	Film Diagnosis
2	Muscles of arm	Spindle-celled sarcoma ..	Spindle-celled sarcoma
5	Muscles of arm	Spindle-celled sarcoma ..	Spindle-celled sarcoma
43	Clavicle ..	Syphilitic bone	No evidence of malignant growth
55	Tendon sheath of thumb ..	Granuloma with fibrosis and old hæmorrhage. Limited number of large giant cells	'Myeloma'
57	Ulna	Calcifying chondroma ..	Hyaline cartilage
66	Femur	Round-celled sarcoma ..	Round-celled sarcoma
72	Popliteal space	Spindle-celled sarcoma	Sarcoma, probably spindle-celled
88	Groin	Myxosarcoma	Spindle-celled sarcoma
90	Arm	Spindle-celled sarcoma ..	Spindle-celled sarcoma

Table II.—RESULTS IN DETAIL, *continued.*

CASE NO.	ORIGIN OF SPECIMEN	SECTION DIAGNOSIS	FILM DIAGNOSIS
93	Fibula	Giant-celled sarcoma; stroma fibromatous rather than sarcomatous	Giant-celled sarcoma
99	Ulna	Myxochondroma	Myxochondroma
122	Malar bone ..	Spheroidal-celled carcinoma	Spheroidal-celled carcinoma
142	Tibia	Round-celled sarcoma ..	Large round-celled sarcoma
146	Muscle of neck (case of carcinoma of larynx)	Chronic interstitial myositis..	No evidence of carcinoma
157	Muscle of tongue (case of carcinoma)	No evidence of carcinoma ..	Striped muscle-fibres and fatty tissue: no evidence of carcinoma
170	Radius, fractured at site of pre-existing tumour	No evidence of malignancy. Old hæmorrhage in fibro-fatty tissue	Hæmatoma. Blood pigment inside fibroblasts, and one myeloplax present
185	Skin	Blood-clot	Blood; red cells almost entirely disintegrated. No evidence of neoplasm
185	Spine	Endothelioma of meninges ..	Round-celled sarcoma

B. **SKIN, TONGUE, LIP, Etc.** (37 *Cases*).

SECTION DIAGNOSIS	NO. OF CASES	FILM DIAGNOSIS	NO. OF CASES
Squamous-celled carcinoma ..	13	Squamous-celled carcinoma ..	11
		Carcinoma	1
		Inflammatory, no *positive* evidence of carcinoma	1
Basal-celled carcinoma	5	Basal-celled carcinoma	4
		Malignant tumour	1
Papilloma	5	Papilloma	5
Sebaceous tumour	3	Sebaceous tumour	3
Hæmatoma	1	Hæmatoma	1
Non-specific inflammation	8	Non-specific inflammation	7
		Squamous-celled carcinoma ..	1
Chronic granuloma, probably tuberculosis, possibly syphilis ..	1	Chronic inflammation, tuberculosis or possibly syphilis	1
Round-celled sarcoma	1	Round-celled sarcoma	1

Table II.—Results in Detail, *continued.*

This group includes the two errors made in lip ulcers already described (p. 254). In the other cases, including a granuloma of the nasal septum, sent with a clinical diagnosis of sarcoma, the film report was scarcely improved upon by the diagnosis made on the section.

C. **THYROID** (9 *Cases*).

All were correctly reported on the films as non-malignant, and the diagnosis of exophthalmic goitre was correctly made in one out of two cases.

D. **SALIVARY GLANDS** (9 *Cases*).

Section Diagnosis	No. of Cases	Film Diagnosis	No. of Cases
Myxo-endothelioma	4	Myxo-endothelioma	3
		Malignant tumour	1
Normal salivary gland	1	Normal salivary gland	1
Lipoma	1	Fatty tissue only	1
Spheroidal-celled carcinoma ..	2	Spheroidal-celled carcinoma	2
Spindle-celled sarcoma	1	Spindle-celled sarcoma	1

E. **GASTRO-INTESTINAL TRACT** (21 *Cases: stomach* 7, *liver* 1, *bowel* 5, *appendix* 4, *peritoneum and omentum* 4).

Chronic inflammation	9	Chronic inflammation	7
		No evidence of carcinoma	1
		Columnar-celled carcinoma, but tissue suggests normal intestinal mucosa	1
Adenoma	1	Normal epithelial tissue	1
Columnar-celled carcinoma.. ..	6	Columnar-celled carcinoma.. ..	3
		Spheroidal-celled carcinoma ..	3
Spheroidal-celled carcinoma ..	2	Spheroidal-celled carcinoma	2
Carcinoma of appendix	1	Malignant tumour, ? round-celled sarcoma	1
Spindle-celled sarcoma	1	Spindle-celled sarcoma..	1
Tuberculosis plus sepsis	1	Tuberculosis plus sepsis	1

It was not always found possible to diagnose correctly on the film whether a carcinoma was columnar- or spheroidal-celled. The sections of the columnar-celled carcinomata examined usually showed areas of the spheroidal-celled type of growth, and frequently in the film the spheroidal-celled portion only was recognized. A carcinoma of the appendix, without a knowledge of its origin, was diagnosed as 'a malignant tumour, possibly a round-celled sarcoma'. The case of diverticulitis diagnosed as a carcinoma is referred to in detail on page 254.

Table II.—RESULTS IN DETAIL, *continued.*

F. **BREAST** (54 *Cases*).

SECTION DIAGNOSIS	NO. OF CASES	FILM DIAGNOSIS	NO. OF CASES
Spheroidal-celled carcinoma ..	37	Spheroidal-celled carcinoma ..	37
Chronic mastitis	7	Chronic mastitis	7
Galactocele	1	Galactocele	1
Fibro-adenoma	3	Atypical carcinoma	2
		Spheroidal-celled carcinoma ..	1
Tuberculosis	1	Non-malignant, giant cell present ..	1
Fibrosarcoma	1	Fibroma	1
Duct papilloma	2	Duct papilloma	1
		Adenomatous tissue	1
Acute infective mastitis ..	1	Acute infective mastitis	1
Spindle-celled sarcoma	1	Spindle-celled sarcoma	1

In *Table II F* the full record is given of 54 breast cases which were examined by this method. Out of the total, there were 44 cases of carcinoma and chronic mastitis which were diagnosed correctly in every instance, this being a most important practical application of the rapid method. About a dozen of these cases were examined while the surgeon awaited with an anæsthetized patient to decide the mode of completion of the operation. The errors made in this section are discussed in detail on page 254.

G. **LYMPH GLANDS** (59 *Cases*).

Squamous-celled carcinoma ..	14	Squamous-celled carcinoma ..	11
		Spheroidal-celled carcinoma ..	1
		No evidence of malignancy ..	2
Spheroidal-celled carcinoma ..	10	Spheroidal-celled carcinoma ..	8
		Carcinoma	1
		No evidence of carcinoma ..	1
Melanotic carcinoma	1	Melanotic carcinoma	1
Basal-celled carcinoma	1	Basal-celled carcinoma	1
Carcinoma	1	Chronic lymphadenitis and necrosis ..	1
No evidence of carcinoma ..	19	No evidence of carcinoma ..	18
		Carcinoma, scattered	1
Chronic inflammation	5	Chronic inflammation	5
Tuberculosis	4	Tuberculosis	4
Alveolar sarcoma	1	Spheroidal-celled carcinoma ..	1
Perithelioma	1	Malignant growth	1
Lymphadenoma	2	Lymphadenoma	2

Table II.—RESULTS IN DETAIL, *continued.*

In the above 59 cases carcinoma was found in the section in 3 cases where none had been found in the film; in each case the deposit was a small islet. Conversely, in one case, that of a gland from the axilla secondary to a carcinoma of the breast correctly reported on by the film method, scattered carcinoma cells were found in the film, but none were seen in the gland at the level the section was made. This discrepancy is only to be expected, as a small deposit of carcinoma in a gland is as likely to be missed by one method as the other.

The 19 cases referred to as 'no evidence of carcinoma' were all glands examined specifically for secondary growth, and showing no gross abnormality.

H. **GENITO-URINARY SYSTEM** (18 *Cases: kidney* 6, *prostate* 7, *bladder* 1, *uterus* 3, *ovary* 1).

SECTION DIAGNOSIS	NO. OF CASES	FILM DIAGNOSIS	NO. OF CASES
Hypernephroma	2	Hypernephroma	1
		Malignant tumour, probably carcinoma	1
Columnar-celled carcinoma ..	1	Carcinoma, villous type	1
Adeno-carcinoma	2	Spheroidal-celled carcinoma ..	2
Carcinoma, showing giant cells ..	1	Spindle-celled sarcoma	1
Squamous-celled carcinoma ..	1	Squamous-celled carcinoma	1
Sarcoma, cylindroma type ..	1	Sarcoma	1
Adenoma	5	Adenoma	5
Myxoma	1	Myxoma	1
Fibroma	1	Simple connective tissue	1
Inflammatory	3	Inflammatory	3

The case diagnosed as a spindle-celled sarcoma was a bladder tumour showing many large multinucleated giant cells and what were regarded as spindle-shaped sarcoma cells; the paraffin section showed it to be a transitional-celled carcinoma with giant cells present.

SURVEY OF METHOD.

We wish to emphasize that this method of fixation provides a very beautiful method of demonstrating the appearances of malignant and other cells, showing the structural details of the individual cells in a manner not seen in the corresponding sections. This is explained by the perfect fixation which is obtained of the wet cell in Schaudinn's fluid.

Appearances of Cells.—We have found that, in general, malignant cells appear larger than the corresponding normal epithelial or connective-tissue cells; the nucleus is frequently excentric, and occupies a larger proportion of

the whole cell. A reticular staining of the nucleus, the presence of nucleoli, and mitotic figures are usually clearly seen. The individual malignant cells may vary considerably in size, whereas the film preparations of a simple tumour or of a normal tissue show cells of a regular size and appearance, with small, evenly stained, centrally-placed nuclei.

Arrangement of Cells.—The manner of the breaking up of the cells in the film also depends upon the type of tissue. A normal tissue, if scraped, does not make a good film, because fragments of normal tissue, such as plaques of squamous epithelium, shreds of mucosa showing complete tubular glands, and strands of fibrous tissue occur as isolated masses without intervening cells. Scrapings of a simple tumour, such as an adenoma of the prostate, show the cells in rather smaller clumps than in a scraping of normal tissue. The individual cells are of normal size and appearance, but the complete glandular structure is not seen, and isolated cells are comparatively few. A carcinoma breaks up much more completely: the cells are not only different in appearance, but perhaps half the cells present will be isolated like cells in a blood-film, while only a certain proportion will be grouped in twos, threes, or in small plaques. The stroma of a carcinoma is not usually seen, hence the occasional difficulty in distinguishing a carcinoma from a sarcoma. The cells of sarcomata, as a rule, break apart from one another almost completely, giving a uniform film of cells with few, if any, plaques of tissue.

It is of particular interest that new growths of low malignancy, such as rodent ulcers and parotid tumours, of which we have examined 9 specimens, show in their film histology characters intermediate between the typical carcinomata and the simple tumours. The cells are rather more regular in size, and the nuclei stain darker and more evenly. The film usually shows considerable plaques of tissue as well as large numbers of isolated cells.

Post-mortem Specimens.—We have found the method unsuitable for the examination of post-mortem specimens, in the few cases in which it was tried, owing to tissue autolysis.

CONCLUSIONS.

1. A wet-film method for the examination of new growths and inflammatory tissues is introduced.
2. The technique is very simple, and requires no elaborate apparatus.
3. The time required for the preparation of the microscopical specimen of a tissue removed at operation is from eight to ten minutes.
4. The method is unsuitable for post-mortem specimens.
5. Two hundred cases have been so examined, and 191 correct diagnoses returned.
6. Special experience of this method should be acquired before it is employed in practice.

REFERENCES.

[1] SHAW, E. H., "The Immediate Microscopic Diagnosis of Tumours at the Time of Operation", *Lancet*, 1910, Sept. 24; 1923, Feb. 3.

[2] DUDGEON, L. S., and JEWESBURY, R. C., "The Bacteriology of Human Milk", *Jour. of Hygiene*, 1924, xxiii, No. 1.

RUPTURED URETHRA: A NEW METHOD OF TREATMENT.

By HARRY BANKS,

SURGEON AND RADIOLOGIST, GENERAL HOSPITAL, ABERDARE.

THE following method of treating rupture of the urethra is based on three cases which came under my care in 1924. So far as I am aware, the method has not been described before.

Suprapubic cystotomy is done and a fully curved metal prostatic catheter is passed through the internal meatus along the urethra to the seat of rupture. Another fully curved metal catheter is passed through the external meatus along the urethra until it comes in contact with the first. The two catheters are then taken one in each hand and gently manipulated until their beaks lie in contact with one another, end to end. By gently withdrawing the first catheter and pushing the second one farther in, keeping the beaks in contact, it is possible to guide the second catheter past the seat of the rupture and into the bladder. No force is required. The second catheter is made to protrude through the suprapubic opening and a self-retaining rubber catheter is attached to it by means of a silk thread. The metal catheter is then withdrawn from the external meatus and in this way the self-retaining catheter is drawn into place past the rupture. The opening in the bladder is closed and a small drain placed in the space of Retzius. The patient is given cystopurin and encouraged to drink plenty of water. Each day after the third day the bladder is gently irrigated with boracic lotion to diminish the formation of deposit on the beak of the catheter. At the end of ten days the self-retaining catheter is removed. This may require an anæsthetic.

My three cases have been of a similar nature, each being that of a collier crushed underground, with multiple fractures of the pelvis and rupture of the membranous urethra. In no case had the patient passed urine between the time of the accident and the operation, nor had he attempted to do so, with the result that there was no extravasation of urine. Each was immediately warned not to make the attempt.

With regard to diagnosis, this was made by trying to pass a catheter into the bladder. Failure to accomplish this is the indication for the operation described. A soft rubber catheter should first be tried, and if unsuccessful a medium-sized metal one. The metal catheter gives a better sense of touch and position, and it is sometimes possible to negotiate the rupture with it, particularly in cases of incomplete tear. Bleeding from the external meatus and a swelling in the perineum were constant signs.

In one of my cases in which the violence causing the accident was very severe, on passing a metal catheter for diagnostic purposes the instrument was felt to go in as far as the region of the triangular ligament, when it became

quite free and appeared to be in a cavity, which indeed it was, in front of the bladder; with it could be felt loose bone, and at the subsequent operation it was found that the bladder and prostate had been literally dislocated from the urethra. In spite of loose bone no sepsis occurred and convalescence was uneventful.

Each case got on well and there has been no difficulty during the three years which have elapsed since the accidents, a mild orchitis in one case being the only complication. Operation was performed within three hours of accident.

Since performing this operation I have had made for me by Messrs. Weiss a special catheter. It is made of copper, size No. 8, and, being pliable, it can be bent to a suitable curve. As shown in the illustration (*Fig.* 192) one

FIG. 192.

extremity is open and slightly bell-mouthed. This enables the point of the catheter introduced through the internal meatus to be more easily engaged. At the other extremity is a small hole to take thread for attaching the self-retaining catheter.

Although it is obvious that accurate conclusions cannot be drawn from so small a number of cases, it appears to me that this method offers the following advantages over opening the perineum: (1) The operation can be performed rapidly; this is of importance, as most of these cases have multiple injuries and suffer from severe shock. (2) There is less formation of scar tissue at the seat of rupture. (3) Drainage of the space of Retzius is provided for, and sepsis does not occur.

THE PATHOLOGY AND TREATMENT OF A VESICAL TUMOUR RESEMBLING AN ENDOMETRIOMA.

By A. CLIFFORD MORSON, O.B.E.,

SURGEON, ST. PETER'S HOSPITAL FOR URINARY DISEASES, LONDON.

The common growths of the bladder belong to the epithelial group of tumours, and fall readily into two genera, papillomata and carcinomata. The latter arise either primarily from the squamous cells of the mucous membrane, or secondarily from the papilloma or wart. Examples of the change in the character of the latter are well known in other parts of the human body. Experimentally they have been produced in animals, more especially in rats and mice.

A search in the literature on the subject of vesical tumours has revealed a description of an epithelial lesion which has been termed an adenoma. The definition of an adenoma is that it is a tumour constructed upon the type of, and growing in connection with, a secreting gland. Another characteristic is that it is encapsuled.

The investigator's attention is naturally drawn to the evidence which is available of the presence of secreting glands in the wall of the bladder. Lendorf in 1901 described certain glandular structures around the urethral orifice and at the base, which consist of solid epithelial down-growths and glands with one to five lacunæ draining into a single excretory duct. In the posterior wall of the bladder only the epithelial in-growths are found, and the apex is free from glandular structures. These glands are stated to have a mucus-secreting function, but this is disputed by Eggling. Glandular structures have been seen also by Tourneaux and Hartman, Rauber-kopsch, and Zuckerkandl. Jordan and Ferguson state emphatically that the mucous membrane, except in the urethral orifice, contains no glands. In this situation there are a few mucus-secreting glands which are only observed in the male subject and are interpreted as vestigial prostatic tubules. They are not present in children.

From the evidence that has been accumulated it is clear that the internal meatus and base are the only parts of the bladder in which glands can be consistently demonstrated. If glands are so common in other regions as some authorities would have us believe, one would expect to find many more cases of so-called adenomata recorded.

The literature on the subject of these rare tumours is confined to a description of barely twenty cases, some of which, in the opinion of the writer, cannot be claimed as primarily arising from the bladder wall. Thus the notes of the cases given by Bridoux, Geraghty, Uteau, and others, in which the tumours occur in the male sex, and arise either from the base of the bladder or around the internal meatus, lead one to the definite conclusion

that they are prostatic in origin. These tumours, however, correspond to the pathological definition of an adenoma, whereas those described by Rinaldi Cassanello, Sacchi, and De Korte and classed as adenomata, the writer submits cannot be included in that category. The tumour in each of these cases arises from the posterior wall of the female bladder, is not connected with a secreting gland, and is not encapsuled. All the female cases are characterized by severe hæmaturia.

At this point a brief reference to the articles by the three authors named will serve to focus the attention on the main lines of the argument which is being elaborated. Rinaldi Cassanello's patient was a female, age 40, with a normal menstrual history. She had had severe hæmaturia for six months. A neoplasm, the size of a Tangerine orange, was observed on the posterior wall of the bladder close to the right ureteric orifice, and was found to be independent of the uterus. The tumour was removed by an open operation by local excision and was obviously not encapsuled. Recovery was complete. Six months later, nephrectomy for abscess of the right kidney was performed. The author describes the bladder growth as an adenoma, but states there is uncertainty whence it arises.

G. Sacchi records a case of a woman, age 50 years, with severe hæmaturia, due to a smooth broad-based mass the size of a pigeon's egg, beyond the left ureteric orifice, which was excised by open operation. Recovery was good. Histological examination showed that the lesion was an adenoma undergoing cystic degeneration.

Finally, W. E. De Korte describes an operation for the removal of a bladder tumour of the posterior wall in a woman of 56 who had suffered from severe hæmaturia. Three weeks after the operation the patient complained of pain in the right iliac fossa, and at a later date a number of subperitoneal cysts containing mucin were found and evacuated. Death took place in three years. The microscopic sections of the vesical growth demonstrated, according to this observer, an adenoma similar in appearance to a rectal polyp.

There is much similarity in the descriptions of these three cases. All occurred in women, all had severe hæmaturia, all the tumours were removed from the posterior wall, and all were supposed to be adenomata. None of these investigators, on the other hand, suggests from what gland the adenoma arises.

The Author's Case.

In March, 1923, Mrs. W., age 42, was referred to the writer by Mr. Gordon Luker, late gynæcologist to the London Hospital, on account of painless hæmaturia. A piece of tumour had been previously passed per urethram which proved on microscopic examination to consist of columnar cells. Under general anæsthesia a complete examination was made of the pelvic organs. Cystoscopy (*Fig.* 193) showed a tumour the size of a walnut growing from the posterior wall of the bladder and covering the right ureteric orifice. On another part of the posterior wall was a plaque-like swelling the size of a postage stamp.

Dilatation and curettage of the uterus by Mr. Gordon Luker showed no

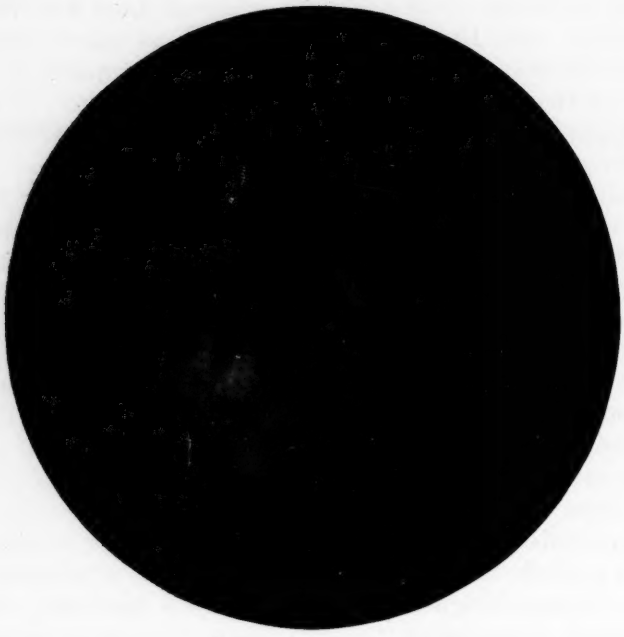

FIG. 193.—Appearance of tumour before diathermy treatment was commenced.

FIG. 194.—Drawing of a microscopic section of a part of the tumour which resembles the glands of the uterus. (× 54.)

evidence of disease of either the endometrium or interstitial tissue. The writer then proceeded, by means of an open operation and diathermy, to remove the bladder growth together with the adjacent plaque-like mass. The patient's convalescence was uneventful.

Fifteen months later the tumour recurred on the posterior wall, and was destroyed by means of transurethral diathermy. In June, 1926, though the general state of health remained excellent, there was a recurrence of hæmaturia, and again a small tumour was treated with diathermy. Six months later this woman reported an attack of pain in the right loin, with fever, symptoms suggestive of ascending infection up the right ureter due to obstruction of the orifice by growth. This was confirmed by cystoscopy.

It was now clear that the cells of the tumour were becoming resistant to the action of a diathermy current of not more than 10 milliampères. Recently, by the technique advocated by Frank Kidd, and using his special diathermy cystoscope, a current of 1·7 ampères has been passed through the tumour. Should this treatment fail, recourse will have to be made in the near future to hemicystectomy and transplantation of the right ureter.

The microscopic sections of the growth show a hyperplasia of gland acini, lined with a deep columnar epithelium in a delicate vascular stroma containing numerous small round cells of inflammatory type. The epithelium lining the acini is very regular and is limited by the basement membrane, but there is active proliferation of the cells within the acini. The glands closely resemble those of the uterus. There is no definite evidence of malignancy. Thus this tumour has more of the characteristics of an endometrioma than of an adenoma. Clinically it is similar in every respect to those described by Cassanello, Sacchi, and De Korte.

Brakemann in 1924 recorded the discovery of a tumour the size of a walnut on the posterior wall of the bladder, which was removed during laparotomy for other conditions. No mention is made of the presence of any vesical symptoms, but the pathological report is identical with that of the author, namely, glandular cavities similar to adenomyohyperplasia uteri.

Much attention has been given in recent years by gynæcologists to the pathology of endometriomata. A theory has been put forward by Sampson, Vernon Bailey, and others, that pelvic endometriomata are the result of endometrial grafts due to the back-flow of the menstrual discharge from the uterus through the Fallopian tubes, but this cannot account for their presence between the layers of the broad ligament and having no communication with the peritoneal cavity. Such a case has been described by Beckwith Whitehouse. The latter has also removed an endometrioma from the antero-superior surface of the uterus, which was invading the peritoneum of the utero-vesical pouch and fixed to the bladder. A portion of the bladder wall had to be excised with the tumour, which was found to have no communication with the uterine cavity either macroscopically or microscopically.

The position of these two tumours appears to call for another explanation than that based upon the assumption of endometrial grafts. Support for this view is given by the presence of growths in the bladder which closely resemble uterine tissue and must be classed as endometriomata. In this

situation it is impossible for endometrium from the uterus to graft itself into the bladder wall, and, of all the theories which attempt to explain the origin of these interesting tumours, the acceptance of the peritoneal offers the fewest difficulties. This theory assumes that the epithelial cells of the peritoneum, when they proliferate in response to an irritation, the nature of which is unknown, undergo differentiation *in situ* into uterine epithelium. This will account for endometrial tumours of the intestines, the bladder, the groin, and laparotomy scars.

The subsequent history of De Korte's patient, in which subperitoneal cysts containing mucin were found, demonstrates that, whatever view may be held with regard to the nature of the bladder growth, proliferation of the epithelium of the peritoneum was occurring, which is evidence in support of the theory that the primary tumour was an endometrioma. It is also significant that the four tumours described in female subjects by Cassanello, Sacchi, De Korte, and the writer, were situated on that part of the bladder wall which is covered by peritoneum.

Can the endometrioma be classed as a malignant growth? The writer is of opinion that primarily this tumour, like the vesical papilloma, is innocent, but that, just as in the laboratory the skin wart, by means of the application of certain chemical substances, takes on the characteristics of the squamous-cell carcinoma, so, as a result of a persisting irritation, this rare bladder tumour will also undergo a cancerous change.

SUMMARY.

1. Tumours of the female bladder which have been described hitherto as adenomata must be included in the category of endometriomata.

2. The theory which best explains the origin of these tumours is that a metaplasia of the peritoneal epithelium occurs as a result of a long-continued irritation.

3. In all probability the correct treatment is partial cystectomy rather than an attempt at destruction by the diathermy current.

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VOLVULUS OF SMALL GUT, CÆCUM, AND ASCENDING COLON, ASSOCIATED WITH CONGENITAL REVERSED ROTATION OF INTESTINE AND WITH PREGNANCY.

By CHARLES DONALD,

SURGICAL REGISTRAR, LONDON HOSPITAL.

Non-rotation and mal-rotation of the intestine have been comparatively frequently described, but *reversed* rotation, whereby the cæcum and ascending colon occupy their normal positions but the transverse colon passes behind the small intestine and, or through, its mesentery, is extremely rare. Dott,[1] in his admirable article on the abnormalities of rotation, could only cite two cases, one of his own and one of Hunter's ;[2] Harvey[3] has since reported one. The case to be described differs from these both in the abnormality and in the complication.

Embryology.—During early embryonic life there is a temporary herniation into the umbilical cord of the rapidly-growing midgut loop, which comprises that portion of intestine represented in the adult from the duodenum at the bile papilla to the left third of the transverse colon. The base of the loop is narrow, the duodenum being held by the mesoduodenum and the hindgut by a retention band at the colic angle (Frazer and Robbins[4]). The superior mesenteric artery runs down in the loop, dividing it into pre- and post-arterial segments, corresponding to the eventual small- and large-gut portions of the loop.

According to Frazer and Robbins, the normal return of the loop within the abdomen commences with the pre-arterial segment returning first. Because of the liver above, it must pass beneath the distal end of the loop, and behind the superior mesenteric artery. Entering on the right side it meets the median mesocolon and pushes that over to the left. The post-arterial segment now returns and takes up a position anterior to the small gut and the artery. There is thus an anti-clockwise turn of the loop through 270°. The explanation given of the pre-arterial segment returning first lies in the relatively large size of the cæcum, which is the last to reduce.

In reversed rotation there is a clockwise turn through 90° ; the post-arterial segment is believed to reduce first, and thus the transverse colon comes to be behind the jejunum and the superior mesenteric artery.

After return of the loop the process of rotation is completed by descent of the cæcum and fixation of parts of the intestine by fusion of their mesenteries with the peritoneum of the posterior abdominal wall. When abnormalities of rotation occur, fixation is often deficient, and this was particularly evident in the case to be described.

Description of Case.—A female, age 27, was admitted to the London Hospital complaining of twenty-four hours' abdominal pain and vomiting, intermittent at first but almost continuous later. She had absolute constipation, and enemata had failed to give relief. She was fully five months pregnant. Her previous history as regards abdominal trouble consisted of one attack of colic lasting three days at the age of 25. She was an epileptic.

On Examination.—A very ill patient was seen, with almost continual stercoral vomiting, extreme restlessness, and a rapid, thready pulse. The abdomen was hugely distended and tympanitic all over, save where the uterine dullness rose to just below the umbilicus. That acute obstruction was present was evident, and a diagnosis of volvulus was made because of the rapid and extreme distention.

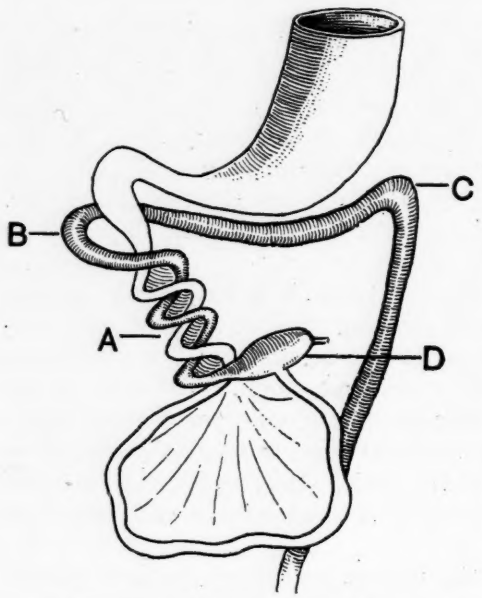

Fig. 195.—Diagram showing twist of two and a half turns of midgut loop in clockwise direction. The retrojejunal position of the transverse colon is also shown. A, Volvulus; B, Hepatic flexure; C, Splenic flexure; D, Cæcum.

Operation.—Through a low paramedian incision, the presenting small gut was found enormously distended and of a uniform blackish-brown colour. Search for the cæcum in the right iliac fossa proved fruitless. The transverse colon could not be found. Further search revealed the cæcum in the region of the spleen, with the appendix blown out like the finger of a rubber glove. The cæcum and ascending colon, the latter freely mobile on the common mesentery, were brought out of the wound, and on placing the cæcum in the right iliac fossa it could be seen that small gut, cæcum, and ascending colon formed a free loop which had still to be rotated in an anti-clockwise fashion for two full turns before things would be normal; that is, the loop had undergone a torsion of two and a half turns clockwise. The torsion was undone, cæcostomy performed, and the operation concluded as quickly as possible because of the low condition of the patient. The diagram (*Fig* 195) indicates the nature of the twist. Death occurred four hours later.

Post-mortem.—The anatomical abnormality was clearly revealed. The small gut, cæcum, and ascending colon were all on one mesentery, the attachment of which to the posterior abdominal wall was short and high up in the abdomen. The first point of fixation was at the hepatic flexure, and the loop hung down freely in front of the transverse colon, which was bound by a mesocolon never more than 1 cm. long close to the posterior abdominal wall caudal to the mesenteric attachment. The duodenum lay in front of the

superior mesenteric vessels, the transverse colon behind. The condition after reduction is depicted in *Fig.* 196.

COMMENTS.

The case illustrates well the fact that anomalies of rotation are often accompanied by deficient fixation of the intestine. The narrow pedicle of the midgut loop predisposed to torsion, and it would appear probable that the

FIG. 196.—Drawing from sketch made at post-mortem. The greater part of the small intestine and the uterus have been omitted for clearness. The retrojejunal position of the colon and the extreme distention are obvious, and by the shading an idea is obtained of the free midgut loop suspended from a narrow attachment above.

enlarged pregnant uterus, by pushing the loop up near its base, was the exciting factor.

Comparison with the three above-reported cases of reversed rotation reveals interesting differences. In Hunter's[2] case in an infant the abnormality was associated with large mesenteric cysts, and taking the view that these were derived from shut-off diverticula of the small gut he concluded

that they had been present on the pre-arterial segment in the physiological hernia, and thus the relatively smaller post-arterial segment had reduced first. In his case no obstruction was present. In Dott's[1] case, fixation of the mesentery in a man of 68 had occurred below the transverse colon as far as the right iliac fossa, so that the colon passed through an aperture in the mesentery; but the cæcum and ascending colon remained free, and volvulus of these only occurred. In Harvey's[3] case the colon of an infant also passed through an aperture in the mesentery, and there was actual obstruction at this point. Thus only in Hunter's case was there an apparent cause for the retrojejunal position of the colon. The present case differs from the others in a greater amount of lack of fixation.

I am indebted to Mr. E. C. Lindsay, under whose care the patient was admitted, for permission to publish this case; to Dr. W. W. Woods, who made the post-mortem examination; and to Professor J. E. Frazer for kind advice.

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ON INJURIES OF THE SEMILUNAR CARTILAGES.

By C. H. FAGGE,

SURGEON TO GUY'S HOSPITAL, LONDON.

Not the least of the surgical benefactions for which we are indebted to Leeds is Hey's pioneer work on internal derangement of the knee-joint, to which in recent years the large operative experience of the Newcastle surgeons has added much knowledge of great value in diagnosis and treatment. When writing in 1912[1] I was surprised to find that the literature on this subject is almost entirely British, and, as far as I can judge, this is still true. It is strange that recent American surgical writings should contain nothing on knee injuries except records of personal experience by Melvin Henderson[2] and McGuire[3]; for a large majority of our cases in the South of England date from football accidents, and one cannot suppose that American football and baseball are less robust or less liable to put abnormal strains on joints than our British varieties. I have tested over and over again Rutherford Morison's[4] concise and classical account of the initial accident and subsequent history which lead to the diagnosis and, as might be expected, have found it most helpful and entirely accurate except in regard to one or two small points.

If there be any surgical condition in which a diagnosis can be made from the history alone it is, in my opinion, a torn semilunar cartilage, though I would be the first to admit that to this, which is only a relative truth, there are very many well-marked exceptions. In the diagnosis of the cases now under review I have been several times struck with the insignificant nature of the alleged primary accident. For example, a medical man, 50 years of age, twisted his right knee playing tennis in June, 1921, but was able to finish the set; he recalls having acute synovitis of the knee as a medical student, but does not know whether it was the same joint. A loose body could be felt in the joint which on exploration proved to be a long tag of the internal semilunar; since its removal in October, 1921, he has been completely free from disability. Of this there are two possible alternative explanations: either these cases are exceptions to Rutherford Morison's description of a well-marked, fairly severe injury immediately followed by effusion, or, as appears more probable, the real causative injury had taken place some years previously and had been entirely forgotten.

Morison has commented on the fact that when the fracture is of the bucket-handle variety the patient does not give the typical history of recurrent disability with effusion from slight injuries, alternating with intervals of varying duration of complete freedom, but is continuously disabled by pain, effusion, locking, or a sense of insecurity in the joint. I am unable to confirm this observation, for, with few exceptions, all my cases of bucket-handle fracture of the internal semilunar complained of recurrent disability with

intervals of complete freedom, and in some cases these intervals were of many years' duration. It may be that in such cases the strip lateral to the line of fracture is only rarely displaced into the intercondylar notch, but usually lies alongside the thicker attached fragment from which it has been torn, and, on the other hand, that when the lateral strip lies constantly in the intercondylar notch continuous disability results. This is obviously incapable of proof, for in an operation on a patient with an intermittent history the finding of a bucket-handle fracture of the internal semilunar with the lateral strip displaced into the intercondylar notch is no proof that the displacement has been constant, though on the other hand, as in one of my cases (G. B.), the discovery of the torn strip lying in its natural position does provide a hypothesis for the intermittent history of these cases and is for other reasons a clinical observation of extreme importance. (I have applied the term bucket-handle fracture to the actual conformation of the initial lesion and not to its subsequent displacement, which seems to me of secondary importance. It may be that I have used this term in a slightly different sense from that in which it was used by Morison, and therefrom have misconstrued his argument.)

Some writers have laid stress in diagnosis on the presence of localized tenderness below and medial to the patella. With this I can agree, but when it is further stated that the injured cartilage can be felt at this spot and rolled under the finger, my operative experience leads me to protest that in a large majority of the torn cartilages which I have exposed it is physically impossible for the cartilage to be palpable. It seems that both tenderness and a palpable mass indicate a swollen synovial fringe which is the expression of synovitis resulting from the loose body in the joint, for I have found such fringes on opening the joint whenever it has been suggested before operation that a torn cartilage was to be felt. In my opinion locking is of no value in differential diagnosis; it is usually present in these injuries, but is equally common in any other form of loose body.

The discussion at the Royal Society of Medicine in 1912 probably brought home to surgeons the fact that no satisfactory explanation of the exact mechanics of the injury had yet been thought out, for Walton[5] tried to prove that the cartilage was fractured in 'full extension', but did not suggest how this is brought about beyond expressing the opinion that the cartilage is " caught between the two bones and subjected to a very powerful crushing force which is liable to fracture " it.

Martin,[6] speaking at the same meeting, laid stress on an 'inward twist' as the chief factor, but he does not give his view of the exact mechanics of the injury, though shortly afterwards he emphasizes a most important point when he draws attention to the close connection of the internal semilunar with the capsule and internal lateral ligament. It is curious that the obvious inference escaped him, for he says, " If the cartilage be nipped between the internal condyle and inner tuberosity of the tibia and *dragged towards the centre of the joint*, . . . a split or tear would result ". It appears impossible that the outer border of the semilunar should be fixed, and yet at the same time the whole cartilage should be dragged laterally; there is no appreciable force for this lateral drag except a sucking of the cartilage towards the centre of the joint, which only occurs in abduction when

the outer free border of the internal semilunar cartilage cannot be nipped. In order to tear the semilunar cartilage longitudinally it is obviously necessary to separate its lateral borders; if the outer border is nipped and cannot therefore move, it is plain that the tear takes place by reason of the inner border being drawn inwards, which is an exact opposite to Martin's hypothesis: this is brought about by extension, or an effort to extend by which the internal lateral ligament is tightened, and so drags the internal semilunar cartilage *inwards* with it, i.e., *away from the centre of the joint.* May this not be the compromise between the opposing views of the two surgeons quoted?

It would appear to me that it does not matter whether the joint is in a position of slight or considerable flexion provided it is also abducted, for this allows of the internal semilunar being drawn towards the centre of the joint while the internal lateral ligament is slack; but in my own view it is essential that from such a position of flexion the joint must be gradually extending at the moment the fracture occurs. Former writers have attributed to rotation at the knee-joint a great part in the causation of this injury; but while it is true that many patients volunteer information that their disability began with a twist of the joint, it is difficult to understand how rotation can be a factor of first importance in the mechanics of this injury, nor, if what is written above is correct, is it necessary to invoke its aid.

It appears to me that the sequence of events is as follows: A young man playing Rugby football has just transferred most of his weight from one leg, say the left, to the right; he suddenly swerves to the right, and in doing so throws his body-weight outside the axis of the right leg so that the right knee is abducted. By this action the internal semilunar is sucked towards the centre of the joint so as to fill up the space which is formed; the knee, though somewhat flexed, is being extended, and it may be that in swerving he also turns to the right or left, thus rotating the femur outwards or inwards; this rotation fixes the outer free thin border of the semilunar, and as by gradual extension of the knee the inner thick attached border of the cartilage is drawn away from the centre of the joint, owing to its firm fixation to the internal lateral ligament, which is becoming tense, the cartilage splits longitudinally between these opposing forces.

I have attempted to work out a mechanical basis for the production of bucket-handle fractures only, for my experience of these is larger than of other types; it may be that this type is primary to all others, i.e., after the cartilage is torn longitudinally a twist continues the line of fracture to the lateral concave margin, and so a tag free in front or behind is produced.

I can scarcely pretend that the above hypothesis is original, for most of the factors concerned have been employed by other surgeons in their explanations, but in some particulars it differs from, and goes further than, the description of others, and as a whole I have not read it elsewhere.

No correct idea of the pathology and causation of this injury is to be anticipated unless the anatomical details of the lesion are accurate. The observation of Morison that the cartilage is always torn and never bodily detached from the capsule is therefore of the greatest importance, though even at the present date many surgeons write and speak of 'detachment'. In

the writer's experience of bucket-handle fractures, to the consideration of which this paper is largely confined, the tear is usually situated within an eighth of an inch of the inner thick attached base of the cartilage; for the almost invariable choice of this position no anatomical or mechanical explanation can be offered. There is only one variety of semilunar injury to which the term 'detached' can be truly applied, and this is the rare lesion of the posterior part of the external semilunar, of which one instance was recorded by the writer in 1912; it was first described by Sir Robert Jones as a snapping knee (*genou à ressort*), in which a loud noise is caused by the escape of the cartilage from between the articular surfaces. The writer's experience, admittedly small, suggests two curious features: (1) That it always occurs in girls; and (2) That, as there is no history of injury, the lesion may be due to some anatomical defect: it is suggested that this predisposing defect is an unduly wide extension of the postero-lateral gap in the attachment of the external semilunar cartilage to the capsule. Normally this gap is only sufficient to allow for the passage of the tendon of the popliteus, which lies upon the edge or base of the cartilage with the intervention of a bursa communicating with the knee-joint. If this postero-lateral lack of support of the external semilunar were abnormally wide, undue mobility of the cartilage must result, and its displacement into the intercondylar notch is only a question of time.

These cases are not common, and are so important that a typical example is worth recording:—

E. B., age 13, had complained of occasional attacks of pain in the left knee for at least seven years; at that time it was suggested by a doctor that an injured cartilage might be at fault. Four years ago the joint was swollen and was immobilized in plaster for three weeks; distention with fluid had occurred several times. Three weeks before I saw her in 1926 her knee gave way when walking and she fell; the next day the joint was swollen, and still gave a sense of insecurity at the time of my examination. The joint frequently locks in about 10° of flexion; this can be readily brought about by the patient by a kind of trick movement which is associated with a sharp noise, and locking having occurred the knee cannot be fully extended. She can as easily release the loose body, when a similar noise is audible. On the date of examination the patient had been unable to unlock the knee for several days, but this was easily done by passive adduction and rotation in the fully-flexed position. The diagnosis of displacement of the posterior part of the external semilunar into the intercondylar notch was verified by operation on Nov. 15, 1926. A thin layer of fatty connective tissue appeared to be the only bond between the posterior half of the cartilage and the capsule; almost the whole of the cartilage was removed, and there has been so far no recurrence of the disability.

My Registrars, Messrs. Doherty and Laver, have analysed the notes of my last 19 cases; their number is so small that it is obviously unsound to make statistical deductions from them. I have already drawn attention to the case of G. B., in which the two halves of the torn cartilage lay in their normal position side by side; this case is an admirable example of the necessity in the surgery of the knee-joint for the same freedom of exposure that I was

privileged to learn from Arbuthnot Lane thirty years ago in the surgery of the abdomen. I am confident that in times past I must often have overlooked a bucket-handle fracture from not having realized that the torn strip might be lying in its normal position, and I have not infrequently felt that others operating upon the knee scarcely gave themselves a fair chance of success owing to the extremely limited incision which they employed. A curved skin incision lying parallel to and half an inch outside the inner border of the articular surface of the internal condyle can be carried downwards and inwards until over or beyond that internal lateral ligament, and upwards into the vastus medialis; in the latter direction it may be prolonged to any desired extent, so that the patella may be dislocated outwards and the joint explored. As the aponeurotic layers are cut through below, the internal lateral ligament is identified and carefully preserved; I have never dared, or thought it necessary, to dissect this up from the tibia as practised by the late Mr. Kellock. A four- or five-inch division of the synovial membrane is ample to ensure that no lesion will be overlooked; as a rule, in a bucket-handle fracture, the torn strip is found in the intercondylar notch, but if no lesion is found to account for the disability, abduction of the joint may disclose this strip lying in its normal position, though attached only in front and behind.

This anterior attachment is very carefully cut through so as to leave no projecting roughness which might later give trouble; but the posterior attachment does not need such careful trimming off, as a projection in this position cannot cause locking. Except in very few cases of semilunar injury I have not found it necessary to attempt to remove the whole cartilage. If no lesion of the cartilage is discovered, the joint is closed. I have on a few occasions, but not for over ten years, removed a synovial fringe which has appeared to be thickened; I do not now regard this as a primary condition, and the change is usually general. Removal of such fringes has led to no successes in my hands.

The synovial membrane is now brought together with a continuous suture of Lukens No. 1 iodized catgut, beginning at the top of the incision; when the lower margin is reached, the suture is continued into the aponeurotic layers from below upwards and tied to the beginning of the synovial suture; this I regard as important, for the only vessels cut during the operation (anastomotic connections between the anastomotica and the superior internal articular) lie between these two layers and are secured by the above means. Otherwise, owing to the use of the tourniquet, the vessel cut will not bleed during the operation, and being easily overlooked may give rise to a post-operative hæmarthrosis.

The insertion and tying up of this suture is done by instruments only, as part of the Lane technique which is employed throughout. Over abundant dressings a whole roll of wool is wound and secured by a domette bandage applied as tightly as possible; the tourniquet is then removed.

It is perhaps fortunate that this operation is usually called for in healthy young men who bear pain well, for it certainly is followed by more pain than the majority of common operations. Aspirin is given freely, and even three or four morphia injections may be necessary during the first forty-eight hours

for the relief of pain in preference to disturbing the dressing in any way. The limb with the knee slightly bent is supported on pillows, but in spite of this the leg usually swells.

Since applying the dressing in the way just described I have seen no case of post-operative hæmarthrosis, but some ten years ago I had to re-open a knee and wash out much sterile clot.

The commonest ill-effect has been wasting of the vastus medialis; this brought the operation into some discredit during the War, as boards were fearful of returning such men to the line; it usually clears up after two or three months have elapsed from the date of operation, but, even if apparent to the eye, causes no functional disability. The patient moves his knee when and as much as he wishes; passive movements are absolutely barred; he is up and walking in seven to ten days, when massage of the quadriceps is begun.

I think that in every case in which I have found a gross lesion the result has been good. In this series are included three Guy's men whom I recently saw playing together in a match twenty, eight, and seven months after operation; their joints were unsupported and no disability resulted.

It is my custom to regard the diagnosis of torn semilunar in a patient over 30 with the utmost suspicion; yet among these 19 cases 2 were over 50; the eldest, a man of 64, who earned his living pruning vines, explained that unless operation would enable him to climb ladders in safety his livelihood was gone. He had suffered from continuous disability for six months owing to a bucket-handle fracture, and removal of the strip from the intercondylar notch has enabled him to return to his former work.

In middle-aged men the diagnosis from a chronic arthritis of the osteo-arthritic type has been of much difficulty, and particularly as the arthritis may be secondary to a torn cartilage. Operation on an arthritic joint which discloses no causal lesion has, in my experience, been followed by exacerbation of all symptoms, and from the point of view of function and wage-earning capacity has proved a major surgical calamity.

The following summary includes every case during the period under review in which the knee has been explored for a supposed semilunar injury; in every case a gross lesion has been verified and demonstrated to others.

Cases: Males 18, females 1.

Age incidence: Under 20 years, 3; under 30 years, 10; under 40 years, 2; under 50 years, 1; under 60 years, 1.

Semilunar injuries: Internal 18, external 1.

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ACCESSORY BREASTS IN THE LABIA MAJORA.

By ROBERT PURVES,

SURGEON TO THE LINCOLN COUNTY HOSPITAL;

AND J. A. HADLEY,

SENIOR HOUSE SURGEON TO THE LINCOLN COUNTY HOSPITAL.

Accessory breasts are not uncommon in both males and females. They occur with and without nipples. Usually there is one or a pair, but up to nine have been recorded by Hirst.[1] Generally they occur in a line from the anterior axillary fold to the inguinal region, but cases have been recorded of accessory breasts on the shoulder, back, buttocks, or thighs. Cases of four and six breasts have been observed frequently, usually in pairs, situated above or below the normal site. In women, accessory breasts have attracted attention for the first time during pregnancy or lactation by the increase in size and secretion of milk. Until such times the rudimentary nipple has been mistaken for a mole. In some cases there has been no nipple. Smeddon[2] reported a case of a woman who had an accessory breast in each axilla. The tumours had no nipples or external openings, and no connection with the normal breasts. After parturition they increased in size and then disappeared in five weeks. The tumours had appeared at former confinements, and were among the first signs of pregnancy. In a few instances polymastia appears to be hereditary.

The explanation of the usual site of occurrence is not settled, but the view widely held is that, in the progenitors of man, breasts were present in a line from the axillæ to the groins, and that, as the change from multiple to single offspring took place, there was a gradual diminution in the number of breasts until only two developed normally.

The *Tarsius spectrum*, in addition to pectoral glands, has an inguinal pair, and cetaceous animals have inguinal glands.

Breasts in the labia have been recorded by De Blazio,[3] Hartung,[4] and J. W. Bell.[5] In De Blazio's case they were bilateral, and each had a nipple. Up to the age of puberty, only the nipples were observed, the glands developing later, and only reaching their maximum size when the woman became pregnant. Hartung's case was in a woman of 30 who was suckling an infant, and Bell's case was in a woman past the menopause. The following case appears to be the first recorded in this country.

Mrs. M. J., a multipara, age 34, was admitted to hospital in October, 1923, for hypertrophy of the right breast. For nine months the breast had been enlarging and causing severe shooting pains. It was twice the size of the left one, which was also larger than normal. On palpation the breast was nodular, and the condition was thought to be a proliferating cystadenoma. It was removed on account of its size and its rapid growth.

Pathologically it was reported as hypertrophic breast tissue. In 1924 the patient returned to have the left breast removed on account of its large size and weight. This was done, and the pathological report was that the condition was an adenocarcinoma.

In May, 1926, the patient, who was five months pregnant, noticed a small lump on the left side of the chest in the situation of the scar. This lump was gradually increasing in size, and a second lump had appeared above and towards the axilla on the same side. A third lump appeared on the right side of the chest near the scar on that side. These tumours were diagnosed as breast tissue which had escaped removal at the previous operations, and they were enlarging with the pregnancy. They were not attached to the skin, nor were they fixed to the chest wall. The consistency was that of breast tissue. The operation scars were sound, and no nodules were seen in or near them to suggest new growth. The three tumours were removed, and presented the appearance of breast-like tissue with definite capsules. Pathologically they were reported to be fibro-adenomata of the breast.

FIG. 197.—Accessory breasts. Stained Sudan III. *Red* stain shows large fat globules in acini, indicative of active lactation; *blue* stain, secretory epithelial lining.

In July, 1926, the patient noticed a lump in each labium majus, the left one being larger than the right. As they were increasing in size, the question of their removal before labour arose. It was decided to remove them afterwards, as they were outside the vagina. Delivery was easily accomplished at the end of September.

The patient returned in November, 1926, because the tumours were increasing in size and were painful. On admission there was a tumour in the left labium majus posteriorly, the size of an orange. It was attached to the skin, but moved on the tissues deep to it. Below it was a smaller lump apparently separate. Both were soft in consistency and painful when pressed. The skin over the larger one was ulcerated in two places on its under surface from pressure. The right labium majus also presented a tumour the size of a tangerine orange, similar to those on the left side. The inguinal glands were not enlarged.

The lump in the right labium was dissected out first; it possessed a capsule which separated easily from the underlying tissues. The tumours on the left side were then dissected out, and found to be connected, the upper larger portion being encapsuled, the lower smaller portion consisting of three

or four processes burrowing into the perineal muscles. In removing the lower part it was noticed that milky fluid escaped from the cut surface. The skin wounds healed by first intention.

Microscopical examination of the tumours by Mr. Barnard showed that both consisted of actively lactating breast tissue, the milk in the acini and ducts being clearly demonstrated. (*Figs.* 197, 198.)

There were no signs of nipples on either tumour, or signs of accessory breasts elsewhere.

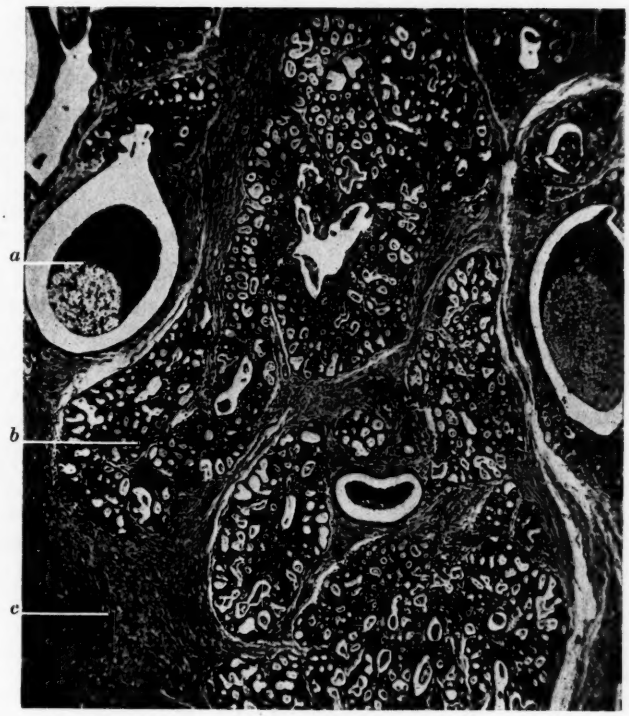

FIG. 198.—Accessory breasts. (*a*) Fat; (*b*) proliferating acini; (*c*) connective tissue.

The patient's pregnancies have been as follow: 1907—child alive; 1910—stillborn; 1915—child alive; 1916—child died at 10 years of age; 1919—child alive; October, 1926—child alive. As regards menstruation, since November, 1926, three periods have occurred, each with very slight loss.

PRESENT STATE.—Patient is now (September, 1927) quite well; there is no swelling in labia or elsewhere, scars are healthy. She is not pregnant.

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A NOTE ON THE GLUCOSE ENEMA AND ITS VALUE IN POST-OPERATIVE TREATMENT.*

By DAVID LEVI,

SURGICAL REGISTRAR TO ST. MARY'S HOSPITAL, LONDON.

This research was undertaken to demonstrate: (1) Whether glucose is absorbed from the rectum in sufficient quantities to make the glucose enema of clinical value; (2) The place of the glucose enema in the treatment of post-operative shock.

In order to ascertain the amount of glucose absorbed by the rectum, glucose enemata were given to two series of patients: (*A*) *To fasting normal men*; and (*B*) *To fasting diabetics.*

PROCEDURE.

Fifty to eighty grammes of glucose were given in 500 c.c. of saline or water. The enema was administered by the ward sister at 9 a.m., the patients having been starved since 6 p.m. the previous evening. The blood-sugar was estimated previous to the administration of the enema, and at half-hourly intervals subsequently for two and a half hours. The blood used for this purpose was obtained by venepuncture and was oxalated, MacLean's technique being employed, and each point of each curve is the mean of two separate estimations.

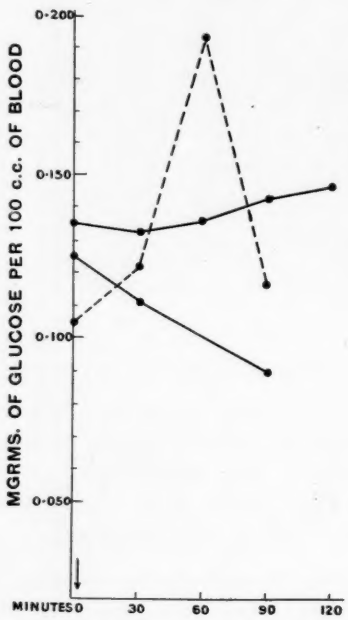

Fig. 199.– Two curves illustrating the changes occurring in the blood-sugar subsequent to the administration of 80 grm. of glucose in 500 c.c. of water by the rectum to two normal fasting men. The broken line shows the curve obtained after the ingestion of the same quantity of glucose by the mouth. Glucose was administered at the point indicated by the arrow.

A. **Fasting Normal Men.**—The curves obtained in this manner from the estimation of the blood-sugar of 16 normal men are appended. In 11 instances the blood-sugar rose, the maximum rise

* From the Surgical Unit, St. Mary's Hospital.

being 0·069 mgrm. per 100 c.c. of blood at the end of one hour and ten minutes. The average rise was 0·024 mgrm. per 100 c.c. of blood. In 5 instances the blood-sugar fell, the maximum fall being 0·035 mgrm. per 100 c.c. of blood and the average fall 0·027 mgrm. per 100 c.c. of blood. Of the 16 cases under consideration in this section, the mean result was therefore a rise of 0·008 mgrm. per 100 c.c. of blood. Rather similar results in a series of 8 cases were recorded by Tallerman[1] in 1920. This small rise of 0·008 mgrm. per 100 c.c. of blood stands in strong contrast to the rise of 0·085 mgrm. per 100 c.c. which occurred when 80 grm. of sugar were given by mouth to normal fasting men (*Fig.* 199).

Table I.—Normal Fasting Men.

Patient's Number	Fasting Blood-sugar	Number of Hours after Administration of Glucose per Rectum					Rise	Fall
		½	1	1½	2	2½		
1	0·086	0·083	..	0·094	..	..	0·008	..
2	0·106	0·079	..	0·103	..	..	..	0·025
3	0·070	0·081	..	0·000	..	..	0·020	..
4	0·065	0·084	0·090	0·099	..	..	0·024	..
5	0·097	0·092	..	0·083	..	..	..	0·014
6	0·106	0·082	0·121	..	..	..	0·020	..
7	0·122	..	0·115	0·115	0·152	0·158	0·036	..
8	0·060	0·098	0·125	0·129	0·097	..	0·069	..
9	0·096	0·111	0·120	R	..	..	0·024	..
10	0·125	0·116	0·090	R	..	..	..	0·035
11	0·082	0·117	0·103	R	..	..	0·035	..
12	0·134	0·146	0·127	0·134	..	..	0·012	..
13	0·096	0·078	0·096	0·085	..	..	..	0·028
14	0·164	0·131	0·135	0·139	..	..	..	0·033
15	0·122	0·122	0·132	0·134	0·126	..	0·012	..
16	0·136	0·133	0·136	0·144	0·148	..	0·012	..

R = Enema returned.

B. **Fasting Diabetics.**—In this group curves were obtained from the estimation of the blood-sugar of 8 diabetics, the procedure being the same as in Series *A*. In 5 instances the blood-sugar fell and in 3 it rose, the maximum fall being 0·065 mgrm. per 100 c.c. whilst the average was 0·038 mgrm. per 100 c.c. of blood. The mean was a fall of 0·020 mgrm. per 100 c.c. of blood. (*Fig.* 200.)

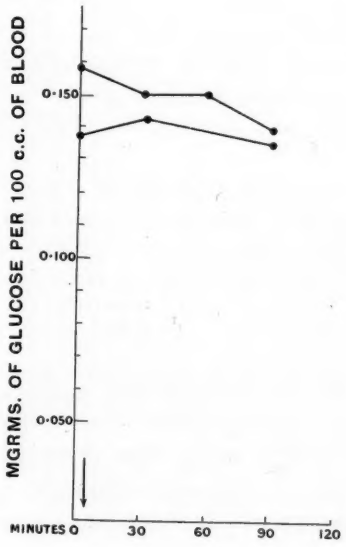

Fig. 200.—Two curves illustrating the changes in the blood-sugar after the administration of 80 grm. of glucose in 500 c.c. of water by the rectum to two fasting diabetics. Glucose enema was administered at the point indicated by the arrow.

Table II.—FASTING DIABETICS.

PATIENT'S NUMBER	FASTING BLOOD-SUGAR	NUMBER OF HOURS AFTER ADMINISTRATION OF GLUCOSE PER RECTUM					RISE	FALL
		½	1	1½	2	2½		
1	0·134	0·146	0·137	0·116	0·138	..	0·012	..
2	0·300	0·236	0·228	0·236	..	..	..	0·062
3	0·207	0·204	0·178	0·182	..	..	..	0·029
4	0·300	0·298	0·300	0·290	..	..	..	0·002
5	0·157	0·150	0·150	0·140	..	..	..	0·017
6	0·237	..	0·189	..	0·187	..	..	0·050
7	0·137	..	0·143	..	0·135	..	0·006	..
8	0·205	..	0·207	R	..	..	0·002	..

R = Enema returned.

Post-operatives.—A series of 10 patients, the subjects of operative surgical procedure, was here investigated. The blood-sugar was estimated both before, and periodically after, operation. In every case it rose, the maximum rise being 0·085 mgrm. per 100 c.c. and the mean rise 0·032 per 100 c.c. It was noticed that the longer was the anæsthetic and the greater

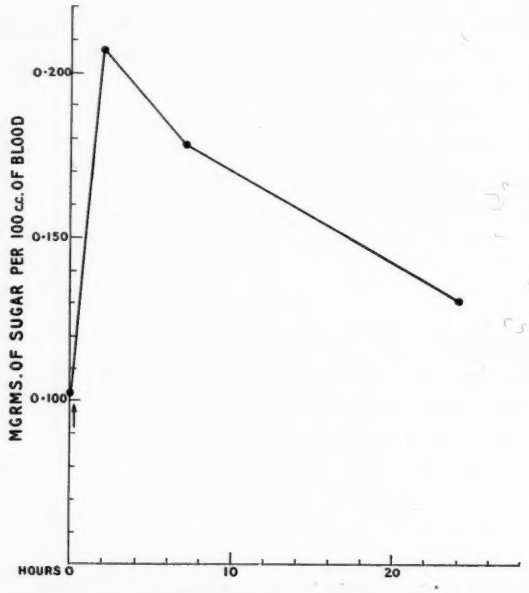

FIG. 201.—The changes occurring in the blood-sugar subsequent to a gastro-enterostomy. Operation at the point indicated by the arrow.

the severity of the operation, the longer the blood-sugar took to return to its pre-operative level. The body, therefore, in the state of 'post-operative shock'—using the term to signify the exhausted condition of the patient after a surgical operation—is permeated with blood containing an excess of sugar which the tissues seem to be unable to utilize. (*Fig.* 201.)

Table III.—POST-OPERATIVES.

PATIENT'S NUMBER	FASTING BLOOD-SUGAR BEFORE OPERATION	HOURS AFTER OPERATION										OPERATION	RISE
		½	2	3	7	8	12	24	36	48	72		
1	·148	·188	·152	..	·156	..	..	·182	..	..	..	Gastrectomy	·040
2	·141	..	·195	..	·193	·190	·185	·190	·198	·181	·162	Duodenectomy	·051
3	·168	·204	·177	..	·162	..	..	·162	..	..	..	Excision of lip	·036
4	·148	·158	..	..	..	..	..	·131	·141	..	..	Removing plate from femur ..	·010
5	·122	·207	..	..	·168	..	..	·140	..	..	..	Gastrojejunostomy ..	·085
6	·126	..	..	·157	..	..	..	·153	..	..	..	Cholecystectomy ..	·029
7	.128	..	..	·156	..	..	..	..	..	..	..	Gastro-enterostomy ..	·028
8	·104	·144	..	..	..	..	..	·104	..	..	..	Laparotomy ..	·040
9	·112	·115	..	..	..	..	..	..	..	..	..	Varicose veins	·003
10	·137	·125	..	·143	..	..	..	..	..	..	..	Gastrogastrostomy ..	·006

CONCLUSIONS.

From the above experiments it is obvious that the rectum and colon vary in their power of absorbing glucose in different subjects; on the whole the rate of absorption is slow, and very little sugar can, apparently, be introduced into the body by this route.

From the practical point of view, rectal glucose would appear to be of little value as a means of maintaining bodily nutrition, and from the above series of estimations it appears to be fortuitous whether absorption occurs at all.

Finally, individuals the subjects of post-operative shock are in a state of hyperglycæmia and seem to be unable to utilize sugar normally, although their tissues are bathed in a fluid containing an excess of this substance. A glucose rectal saline given under such circumstances is not only useless, but also actively harmful, as it would appear that the absorption of fluid from the bowel is actively hindered by the presence of glucose, for we have observed that glucose salines are mildly irritant and are neither so quickly nor so readily absorbed as are normal rectal salines.

The obvious sequence to these investigations seems to be the administration of insulin to patients in the condition of post-operative shock. This has been carried out in a few cases, but the number of these is insufficient to draw a definite conclusion at present; it appears, however, to be of value, and further investigations are in progress.

I should like to take this opportunity to thank the surgical staff at St. Mary's Hospital for their kindness in allowing me to use their cases.

REFERENCE.

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PERI-ARTERIAL SYMPATHECTOMY WITH LIGATURE OF THE FEMORAL VEIN IN THE TREATMENT OF DIABETIC GANGRENE: A RECORD OF FIVE CASES.

By RALPH BROOKE,

HON. ASSISTANT SURGEON TO THE ROYAL WEST SUSSEX HOSPITAL, CHICHESTER.

Until quite recently the operation of high amputation has been the surgical treatment almost universally employed for diabetic gangrene. There is no doubt that this method when adopted has led to the greatest number of successes in the long-run, the patient subsequently remaining free from local recurrence of the disease for some considerable time. Low amputation, when attempted, has usually been followed by disaster.

There is no doubt that the proportion of recurrences after high amputation is at the present time much larger than it should be. The reason for this is not far to seek. It is largely due to prevarication with unnecessary delay before operative measures are adopted, when the time factor is one of extreme importance. The patient (and sometimes the surgeon) will temporize in the hope that an operation may prove unnecessary. The use of insulin as a pre-operative measure has done much to increase this delay; for the progress of the gangrene may be checked for a time, thus too often leading to a sense of false security. A moment's consideration of the underlying pathology of the disease—that it is a malnutrition phenomenon due essentially to changes in the blood-vessel walls of a permanent nature—must lead to the realization that the action of the insulin can only be a transient one, and cannot materially affect the course of the gangrene. Sooner or later the gangrene will recommence to spread in spite of insulin therapy. The amelioration of the local condition is of a temporary nature only, and does not warrant delay in amputation. One cannot overstress the importance of early amputation in these cases. Insulin, however, has its place in the operative treatment of diabetic gangrene. Used as a pre-operative measure, by rendering the patient sugar-free or by temporarily reducing his blood-sugar, it places him in a better position to withstand the anæsthetic and the operation itself.

Hunter's work on the enervation of blood-vessels has opened up a new field in the surgical treatment of these cases. Although still in its infancy, the operation of peri-arterial sympathectomy may yet prove to be the means of treating the condition in a more satisfactory and less radical manner.

Below are appended the notes of five cases of diabetic gangrene treated at the Royal West Sussex Hospital by conservative surgical measures during the last two years.

Case 1.—L. M., age 63, married, three children, was admitted to hospital on Dec. 12, 1926, with a twelve years' history of diabetes mellitus. She had had both eyes operated on for cataract some years previously, and also gave a history of numerous carbuncles.

On Admission.—The patient was found to be a well-covered and robust individual. On the right foot there was a patch of moist gangrene involving the first, second, and third toes, and extending well on to the ball of the great toe, with surrounding œdema of the foot, most marked on the dorsum and extending upwards as far as the ankle. The dorsalis pedis, tibial, plantar, and popliteal pulses were palpable in the left leg, but not in the right. Temperature, 100°; pulse, 100; respiration, 20; urine: sp. gr. 1010, sugar 1·95 per cent, albumin a trace.

Treatment.—On the day of admission, insulin 15 units three times a day was given, and the urine became sugar-free almost immediately, remaining so throughout the patient's stay in hospital. Subsequently the dose was reduced first to 10 units and later to 5 units per diem. A moderately strict diabetic diet was given. On admission the foot was placed uncovered in a radiant-heat bath. It smelt badly, and from time to time exuded a small amount of foul serosanguineous fluid. Two days after admission, as the gangrene and the œdema were extending, an operation was performed.

Under gas and oxygen an incision about 4 in. long was made in the thigh. The femoral vessels were exposed in Hunter's canal and a peri-arterial sympathectomy was performed. For a distance of 1 in. the adventitia was stripped off the artery, two minute muscular twigs being at the same time ligatured. No obvious pallor of the vessel was noticed after removing the adventitia. The arterial walls were thickened, hard, and calcareous. The femoral vein was then ligatured in two places, and the wound closed.

After the operation the leg was returned to the radiant-heat bath. On the next day (Dec. 15) a remarkable change was noticed in the limb. The dorsalis pedis, plantar, tibial, and popliteal pulses were now not only palpable, but of distinctly greater volume than those of the opposite limb. This increase in pulse volume persisted for about twelve days and then appeared to decrease. Two days after the operation a red erythematous line of demarcation was seen at the edge of the gangrenous part. The area of gangrene had not extended since the operation. On the third day it was noticed that the œdema of the foot was less marked, and two weeks later it had almost completely disappeared. The diseased part was much drier. Five weeks after the operation the gangrenous area was quite dry and mummified. Eight weeks later it was almost completely separated from the rest of the foot, being held to it by a small pedicle of sloughing connective tissue. The œdema had entirely disappeared. At the end of the thirteenth week the diseased portion had separated. The temperature was 98·6°, pulse 72, respiration 20. The urine was sugar-free with insulin 5 units daily. No pain was felt in the diseased limb. Up to the time of writing there has been no recurrence of the trouble.

Case 2.—S. H., age 59, a baker. He had been treated for some years for diabetes, latterly with insulin, on which he had remained sugar-free for nearly a year. An intelligent, hard-working man, he attributed his present condition to the fact that for some years he had had a painful corn on the ball of the second toe of the left foot. Three days before admission he noticed that the toe was discoloured and painful. This he thought at first to be due to careless chiropody, and while blaming himself he took little notice of it. Two days later the condition was much worse, and now, thoroughly alarmed, he presented himself at the hospital.

On Admission (Jan. 30, 1927).—Temperature, 100·6°; pulse, 100; respiration, 20. There was well-marked moist gangrene of the second, third, and fourth toes of the left foot, extending up on to the dorsum for a distance of about ½ in. opposite the third toe, with an area of surrounding œdema extending nearly to the ankle-joint. The heart, chest, and abdomen were normal. Urine: sp. gr. 1105, reaction acid, sugar + +, albumin a trace.

TREATMENT.—The foot was at once placed in a radiant-heat bath, and insulin 20 units given daily. The subsequent clinical history of the case is very similar to that of the preceding one. On the day after admission an operation was performed on the left foot. The artery and vein were exposed in Hunter's canal, and a peri-arterial sympathectomy performed, with ligature of the femoral vein. Following the operation the dorsalis pedis, plantar, tibial, and popliteal pulses were all temporarily increased in volume on the side operated upon, and a line of demarcation rapidly formed at the edge of the gangrenous area. On the tenth day, at the man's own request, in order that he might return to his business as soon as possible, a Syme's amputation was performed. The wound healed by first intention, and the patient left hospital, with a very good clean and serviceable stump, fourteen days later. The patient on discharge was sugar-free with 10 units of insulin daily.

Case 3.—H. Y., age 65, a labourer. In December, 1926, whilst at work, the patient was struck on the right foot by a plank which became dislodged by a fall of gravel. The foot was bruised, but no open wound was present. The bruising remained until his admission into hospital on Feb. 21.

ON ADMISSION.—The patient was a robust individual, but his arteries were thickened and tortuous. There was moist gangrene of the whole of the second toe of the right foot, with surrounding œdema spreading on to the dorsum of the foot for a distance of 3 in. The right dorsalis pedis pulse was hardly palpable. The other pulses in the limb were palpable, but not to the same extent as those on the left side. The urine contained sugar ++. The following day the gangrene had extended to the third toe, and the œdema had spread as far as the ankle-joint.

FIG. 202.—*Case* 3. The limb after Syme's amputation. The scar from the femoral operation can be seen.

TREATMENT.—The limb was placed in a radiant-heat bath, and insulin given. As the disease was spreading after twenty-four hours, a left femoral peri-arterial sympathectomy with ligature of the femoral vein was performed under gas and oxygen anæsthesia. Three days after the operation the condition was as follows: The gangrenous area, which had extended a little during the first twenty-four hours after operation, was now stationary and not increasing in size. The right popliteal pulse was of greater volume than the left. The dorsalis pedis pulses were, as near as could be judged, of equal volume. The right foot was sweating profusely, and the patient was complaining of a feeling of heat and fullness in the leg, which had been present since the operation. On the same evening a Syme's amputation was performed without a tourniquet. There was very little bleeding (just a slight ooze at the site of amputation). The subsequent treatment consisted of radiant-heat baths and dry dressings. On April 23 the stump was completely healed. (*Fig.* 202.)

Case 4.—H. J., age 65, was admitted into hospital on April 26, 1927, with a six months' history of a running sore on the little toe following the excision of a corn.

ON ADMISSION.—The patient was found to be suffering from diabetes mellitus. His blood-sugar was 1·2 per cent; urine: sp. gr. 1120, sugar ++, albumin +. The

whole of the left little toe was gangrenous. In addition, the left leg was infected with a gas-forming organism to a point 3 in. below the knee-joint. Crepitations could be elicited on palpation over the lower parts of the limb.

TREATMENT.—Insulin in large doses, 20 units three times a day, was given, and multiple incisions made into the limb, which was then irrigated by Carrel's method. Three days later a left femoral peri-arterial sympathectomy with ligature of the vein was performed under gas and oxygen anæsthesia. Five days later a Farabœuf's amputation was attempted, but deep pus was encountered at the site of operation. It was thought advisable, therefore, to perform a Stokes-Gritti's amputation at a higher level. This was done; but in spite of insulin therapy and radiant-heat baths there was a recurrence of the gangrene in the stump, and the patient died of diabetic coma on June 11, six weeks after admission.

This case is of interest in that it is an example of a clinical variety of the disease which is rather more rapid in its course than is usually the case. The rate at which the disease progresses is of necessity dependent upon two factors—the degree of primary involvement of the pancreas, and the powers of resistance of the tissues of the patient. There are some cases which terminate fatally with rapidly progressing gangrene of one or both lower limbs in the course of forty-eight to seventy-two hours. In such cases the spread of the gangrene is so rapid, even with insulin therapy, that operative measures cannot be undertaken; or, if amputation is attempted, a recurrence invariably and rapidly develops in the stump. Not every case of diabetic gangrene is suitable for surgical treatment.

Case 5.—R. M., age 40, gave the history that three months previously the left leg suddenly became pale and painful and shortly afterwards turned black. On April 20, 1927, he was admitted to hospital.

ON ADMISSION.—He was breathless and at times cyanosed. Examination of the chest showed that the right side of the heart was $\frac{1}{4}$ in. to the right of the lateral border of the sternum. The apex beat was in the sixth space just external

FIG. 203.—*Case* 5. Photograph of limb after removal, showing site of amputation immediately above gangrenous area.

to the nipple line. The auricle was fibrillating. A systolic murmur was heard at the apex conducted to the axilla. There was, in addition, dry embolic gangrene of the whole of the left leg and foot to a point 2 in. below the knee-joint, with a well-defined line of demarcation. The left femoral pulse was faintly palpable high up in the groin.

TREATMENT.—Two days after admission a left femoral peri-arterial sympathectomy was performed, with ligature of the femoral vein, under local anæsthesia. No pulsation of the artery was visible or palpable at the time of operation. Two days later the line of demarcation at the edge of the gangrene was more distinctly marked.

Two weeks later an amputation through the lower third of the thigh was performed under local anæsthesia, using a 2 per cent solution of apophysin and adrenalin. A tourniquet was not employed, as the femoral artery was not patent and was replaced by a solid cord. The wound healed by first intention. (*Figs.* 203, 204.)

FIG. 204.—*Case* 5. Stump after amputation with local infiltration. (Note femoral scar of sympathectomy.)

The interesting feature of this case is that, although when the limb was amputated the femoral artery was found to be replaced by a solid cord, yet there is no doubt that marked congestion was produced in the limb following the sympathectomy, resulting in a quickening up of the process of elimination of the dead tissue. The power of vasodilatation in the smaller vessels distal to the site of the block, which were functioning by means of the collateral circulation, was still, of course, controlled by the nerves running in the vessel wall, although that vessel had lost its blood-carrying function.

There is good reason to believe that the combined operation of ligature of the femoral vein with sympathectomy of the artery is an improvement on either of these measures used by itself. One has only to examine the hard 'gritty' calcareous walls of the blood-vessels in a case of diabetes of some years' duration to realize that, even when denuded of all vasoconstrictor fibres, the power of dilatation of the vessel distal to the site of operation must of necessity be impaired owing to the mechanical obstacle caused by the degeneration of muscular tissue. Vasodilatation does occur after this operation: of that there is not the least doubt; and a form of active congestion of the limb is thus produced. It is to this active congestion that the good effects of the treatment are attributed. Ligature of the vein produces a similar hyperæmia by passive congestion. When these two methods are combined a summation effect is produced.

CONCLUSIONS.

Some cases of diabetic gangrene are too rapid in their course for surgical measures to be attempted. In those cases which are suitable for operative treatment the following method has given good results:—

1. A short preliminary course of insulin therapy to render the patient more fit to stand the operation to follow.
2. Local treatment in the form of radiant-heat baths.
3. Early operation. The operation of choice was a combined method of peri-arterial sympathectomy of the femoral artery in Hunter's canal, with ligation of the femoral vein.
4. After an interval of from five to ten days, low amputation.

THE STRUCTURE AND ORIGIN OF THE 'MIXED' TUMOURS OF THE SALIVARY GLANDS.*

By R. M. FRY,

ASSISTANT IN THE INOCULATION DEPARTMENT OF ST. MARY'S HOSPITAL, LONDON.

For the purposes of this paper, all the tumours of the parotid and submaxillary glands which have been removed at St. Mary's Hospital during the years 1912–23 inclusive have been examined. Three cases have been discarded, in which the process of tumour formation was entirely obscured by chronic inflammatory changes of long standing; omitting these, the total number of cases available for examination is 25. Of these, 17 occurred in the parotid and 5 in the submaxillary, while the origin of the remaining 3 is not known.

The sex distribution shows 11 cases in males and 14 in females. Great variation is seen in the age of onset, the lowest recorded age being 10, omitting one case which is vaguely stated to have started 'in childhood', and the highest age 55. In a certain number of cases details of age were not obtainable.

A remarkably constant feature, which has been noted by many other observers, is the long period which elapses from the first appearance of the tumour until the patient first seeks advice. In only three of these cases is this period less than 5 years (they are 6 months, 2 years, and 3 years respectively), in several it is over 10 years, and in two cases it is as much as 26 and 27 years. In all these cases of long duration it is found that the tumour remained more or less stationary in size for many years, and then suddenly began to grow rapidly, usually without apparent cause, although in some cases the patient attributes it to some blow or injury.

It is not intended to attach any importance to statistics obtained from such a limited number of cases, but this summary is given to show that there is a general agreement between these and the statistics of others who have worked with more material.

STRUCTURE OF A TYPICAL 'MIXED' TUMOUR OF THE PAROTID.

By a typical mixed tumour is meant a tumour having the appearances which have been described under this name by other observers. Out of the 25 cases, 16, or 64 per cent, fall definitely in this class, presenting most of the characteristics which have been described as belonging to these tumours.

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* From the laboratories of the Institute of Pathology and Research St. Mary's Hospital, London.

One of these tumours presents for examination two main parts, the parenchyma and the stroma; the relative proportions of these vary very greatly in different tumours, and in different parts of the same tumour. For descriptive purposes, however, two main types of tissue only need first be considered :—

1. Those parts of the tumour where the cells are abundant, lying closely packed together, and the stroma is very scanty or almost non-existent (*Fig.* 205, A).

2. Those parts where there is much stroma, and the cellular elements are widely scattered, lying singly or in small groups (*Fig.* 205, B).

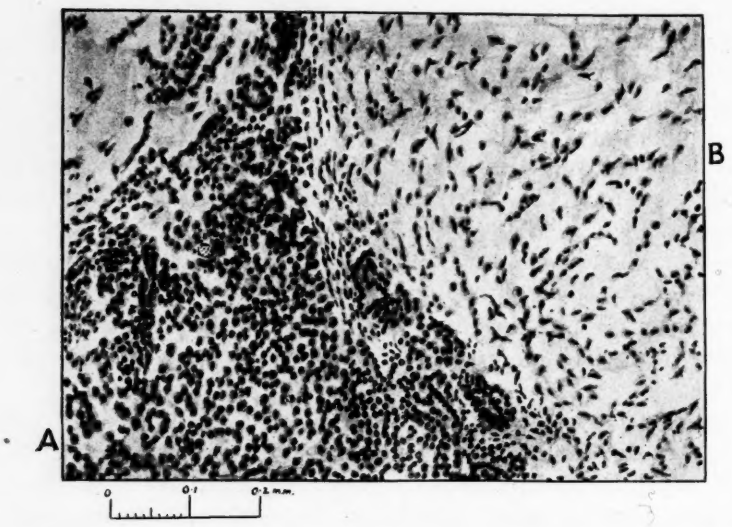

FIG. 205.—Section showing : A, Closely packed cells ; B, Widely scattered cellular elements.

In these two types of tissue, the cells, in addition to the differences in their distribution, present great differences in their form and general appearance.

In *Fig.* 205, A, where there is much parenchyma and little stroma, the cells, being tightly packed together, show very indefinite outlines. In most places they merge into one another, giving the appearance of a syncytium, but occasionally their outlines can be distinguished, and they are then generally polyhedral, cubical, or low columnar. Their nuclei are almost invariably large, and round or oval, showing very distinct nuclear markings, and often a well-marked nucleolus. The cytoplasm shows no special characteristics.

In *Fig.* 205, B, on the other hand, where there is an abundant stroma, the cells undergo great changes in appearance. The nuclei generally lose their regular shape and clear markings, and become irregular in shape, variable in size, and stain uniformly deeply with hæmatoxylin. The cells themselves tend to become triangular or spindle-shaped, and the cytoplasm appears to extend out from the corners of these irregular cells in fine processes which blend imperceptibly with the stroma.

The stroma itself consists of two distinct parts. Firstly, there is a network of fine fibrillar connective tissue running between the cells and groups of cells. This provides support for the cells, and also carries the very limited number of vessels which supply the tumour. These vessels, few in number, are generally very thin-walled, often consisting of merely an endothelial lining. They are present in small quantities in the more cellular parts of the tumour, but are often practically absent from the less cellular parts. In these parts the connective-tissue stroma is practically non-existent too, and it is here that the second element of the stroma comes into prominence—a substance closely resembling mucin. Whether it is pure mucin is difficult

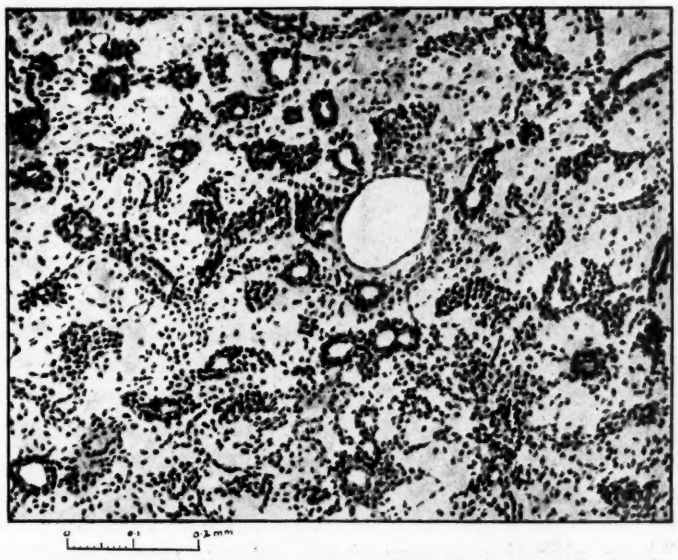

FIG. 206.—Section illustrating the alveolar arrangement of cells.

to say, but microscopically it is indistinguishable from mucin, and stains well, often intensely, with Mayer's mucicarmine. This substance varies in its appearance, in places having a definite fibrillar structure, when it stains most intensely with mucicarmine, and in other places being quite homogeneous in appearance, not unlike the matrix of cartilage. In these parts the staining reaction is not so well marked. There are intermediate stages between these extremes, and all forms may be present in the same tumour, clearly representing different stages in a biochemical change which is taking place.

As will be shown later, this mucinous material should not strictly be regarded as stroma, as in its origin and nature it is quite distinct from the stroma proper, but it is described as such purely for convenience in the account of these tumours.

Finally, in these less cellular parts, especially where the mucinous stroma is homogeneous, the cells occasionally have a special relationship to the stroma, lying apparently free inside small circular vacuoles in the stroma. Round the periphery of these vacuoles there is usually some condensation of the mucinous material, leading to a more deeply-stained ring in a mucicarmine

preparation, and the whole appearance is scarcely distinguishable from a section of cartilage stained by the same method. It may be noted here that the matrix of cartilage stains, though not very deeply, with mucicarmine.

So far, in the account of the more cellular parts of the tumour, only the shape and general appearance of the cells have been described, and no mention has been made of their arrangement. This varies greatly in different parts of the tumour, but the variations may be grouped under four main headings :—

1. Irregular masses of cells, of varying size, in which the cells are closely applied to each other, without any definite arrangement. These portions of the tumour are comparable to the cytomata of Powell White's classification.

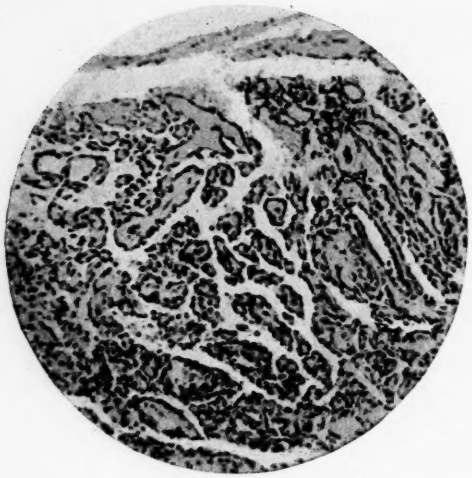

Fig. 207.

2. Adenomatous arrangement. In these parts the cells show a definite tendency to imitate glandular formation, and occasionally nearly perfect reproductions of salivary-gland ducts may be found.

3. Alveolar formation. In such places alveoli of varying sizes are found (*Fig.* 206). Many of these may be formed by the dilatation of the duct-like structures mentioned in the previous paragraph. Another possible method of formation will be mentioned later, when the derivation of the various parts of the tumour is discussed. These alveoli are sometimes empty, and sometimes contain a homogeneous material which stains very intensely with eosin or picric acid. At other times they contain mucin.

4. Rarely a type of tissue is met with which at first sight appears to consist of interlacing double columns of cells which have split down the middle of the columns. On examination of many sections, however, it is found that this appearance is produced by papilliferous ingrowths into dilated alveoli, or by irregular compression of alveoli (*Fig.* 207).

THE ORIGIN OF THE DIFFERENT ELEMENTS OF THE TUMOUR.

In the last forty years there have been many attempts to explain the origin of the mixed tumours of the salivary glands. The main theories which have held the field at different times are as follows :—

1. *The Endothelial Theory.*—This theory, by which the tumours were explained as being derived from endothelium of lymph-vessels, was at one time very widely held, but is now being gradually discarded. It was founded almost entirely on observation of the shape and microscopic appearance of the cells, and these may be explained more easily and plausibly by other theories. It will be shown later, in the detailed discussion of the origin of

the various parts of the tumour, that these tumours do not conform in many respects to the characteristics by which endotheliomata may be recognized. Kettle,[1] in a list of points of importance in diagnosis of endotheliomata, mentions " the absence of any suggestion of a glandular or acinous formation ", and it has already been mentioned that the parotid tumours do in many places show a very definite glandular formation.

2. *The Embryonic Theory.*—A stanch upholder of the embryonic theory is E. Forgue,[2] who places these tumours in a subdivision of the big group of 'dysembryomes', or tumours derived from pluripotential cells which have ceased to develop further at different stages of the development of the embryo, and which have later given rise to neoplasms.

3. *The Branchial Theory.*—The main reason for the launching of this theory was to explain the presence of cartilage in the tumours. It is proposed to show in this paper that the tissue which has gone by the name of cartilage is formed from epithelial tissues, and if this can be demonstrated it becomes unnecessary to consider this theory further.

4. *Origin from Embryonic Gland Germs.*—This theory that the tumours are derived from embryonic rests of gland tissue has been put forward by a limited number of writers, but has never received a very general acceptance. In order to explain the occurrence of epithelium and connective tissue it is necessary to assume that the rests consist of both ectodermal and mesodermal elements, or else that the connective tissue is derived by metaplasia from the epithelium, in which latter case the next theory will account equally well for the appearances observed.

5. *Origin from Fully-formed Gland Tissue.*—By this theory, which is gradually becoming adopted by more and more writers, the tumours are supposed to be derived from adult gland cells. A. Fraser[3] discusses the question, and after comparing the tumours with the effects of ligation of the parotid duct in dogs he comes to the conclusion that the tumours are derived entirely from the cells of the ducts, and that the cartilage is formed by metaplasia from the epithelial elements. R. Kennon[4] also regards them as adenomata, but he gives no account of the formation of the cartilage, which appears to be the point which has given rise to most of the discussion with regard to the origin of these tumours.

In a discussion of the parotid tumour, then, there are two main points which require to be elucidated. They are: (1) *The origin of the cellular part of the tumour*; (2) *The method of formation of the 'cartilage'.*

1. **Origin of the Cellular Part of the Tumour.**—When considering the cells of the tumour, it is clearly necessary carefully to examine their arrangement in different parts of the tumours. Another possible source of light would be the discovery of any definite connection between the tumour and the normal gland, with transitional forms of cells. Thirdly, any evidence of attempts at secretion on the part of the cells may throw some light on the problem.

In attempting to draw any conclusions from the arrangement of cells in a tumour presenting such diversity of arrangement as does the parotid tumour, our chief hope lies in finding cells which by their disposition give some indication of their origin, and tracing as far as possible the development

of other less differentiated cells from these. In a search through many sections of the sixteen tumours now under consideration, one type of formation has been met with which has a close resemblance to normal tissue—the adenomatous formation. This occurs in varying degrees in different tumours; in many it is so obscured by secondary changes as to be almost unrecognizable, but in others it is sufficiently distinct to leave little doubt as to the origin of the cells. One tumour in particular shows this well. It is in all respects a typical 'mixed parotid tumour'; that is to say, it shows all the characteristics which have been ascribed to these tumours, but at the same time the cells show such a marked tendency to form more or less perfect representations of ducts that the arrangement can hardly be regarded as fortuitous. Several of these duct-like formations are shown in *Fig.* 208.

FIG. 208.—Typical 'mixed parotid tumour', showing duct-like formations.

A number of wedge-shaped columnar cells are arranged so as to enclose a small oval or circular space; the cells are well marked off from each other, their nuclei are rounded or oval, lying towards the base of the cells, and showing distinct nuclear markings, and their cytoplasm shows the longitudinal striation so characteristic of the cells of the salivary ducts. The margin of the lumen is very clear-cut and definite, and from this margin can be seen radiating lines, marking the divisions between individual cells. As has already been mentioned, the lumen of one of these structures may present three different appearances:—

a. It may be empty. This may be real, or merely apparent, due to the solution or falling out of the contents.

b. It may contain a homogeneous material, which stains deeply with eosin or picric acid, and strongly resembles the colloid found in the thyroid. This material is referred to by Forgue in a consideration of these 'tubes pseudo-glandulaires'; he considered it due to necrosis of cells formerly occupying the centre of the spaces. It is difficult, however, to accept this explanation, on account of the perfect regularity in the shape of the lumen, with the clear-cut inner borders of the columnar cells bounding it. Such perfect representations of ducts could scarcely be formed in large numbers by mere chance necrosis of the inner members of a mass of cells.

c. It may contain mucin. No stress is laid on this fact by other writers,

but it appears to be intimately connected with the formation of some of the characteristic tissues of these tumours.

There is another point to be noted with regard to these structures, which may be seen to some extent in *Fig.* 208, but is better observed in some of the other tumours—the presence of a double layer of cells enclosing a lumen. In *Fig.* 208, outside the layer of columnar cells, can be seen an irregular layer of nuclei of varying size and shape. The outlines of the cells to which these belong are indistinguishable, but they are strongly suggestive of a ring of irregular cells surrounding the layer of columnar cells. This appearance is met with in a greater or less degree in almost all the tumours. In some the outer layer of cells is very definite; there is an inner layer, sometimes

FIG. 209.—Showing the double layer of cells enclosing a lumen.

columnar, sometimes more flattened; outside this there is a layer of irregular, badly-defined cells, with small deeply-staining nuclei. *Fig.* 209 shows this appearance from another tumour of the series. Fraser has drawn attention to this appearance, and notes its resemblance to the two layers of cells seen in normal salivary ducts. He states that the outer layer of cells may proliferate outwards, thus giving rise to irregular solid masses of cells. This proliferation is well seen in a large number of tumours in this series now under consideration, and it seems probable that the primary structure is in all these cases a duct-like formation, which by proliferation of its outer layer of cells gives rise to large or small irregular masses of cells. The further the cells are removed from the primary duct formation, the more variable

is their appearance; their shape becomes irregular, their cytoplasm loses all definite structure, and their nuclei often lose their definite shape and stain uniformly deeply with hæmatoxylin.

For some time it appeared that the duct was the only source of the tumour-cells, for want of evidence of any other origin. In one tumour, however, a point was found where the tumour and gland came into contact, and the transition from one to the other might be studied. This did not appear to be a case of infiltration of the gland substance by the tumour; there was nothing to indicate malignancy in the structure of the growth, which was encapsuled except at this one place, showed no mitotic figures, and was apparently a slow-growing benign tumour of the rather acellular type. On staining sections rather deeply with hæmatoxylin, the zymogen granules in the secreting cells of the gland stood out prominently as deep bluish-black

FIG. 210.—Zymogen granules standing out in the cytoplasm.

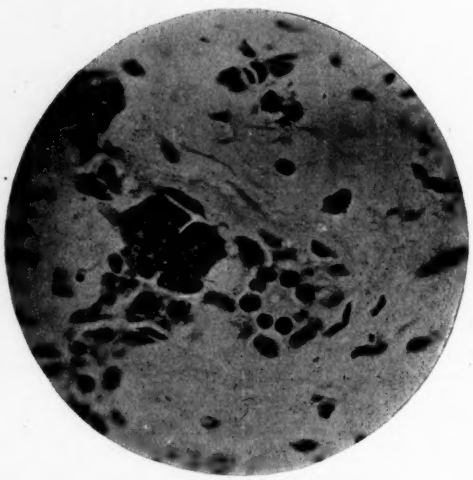

FIG. 211.—Tumour-cells producing mucin, and forming zymogen granules within their cytoplasm.

dots in the cytoplasm (*Fig.* 210). These granules, which are never present in the ducts, were numerous in the normal gland and were absent from the tumour-cells, but round about the point of contact between the tumour and the normal gland many intermediate forms were observed which had definitely lost their normal shape and arrangement. They lay in groups embedded in a matrix of mucinous material so characteristic of these tumours, but yet contained these zymogen granules in varying amounts. Thus we see cells which have taken on what is, as will be shown later, one of the chief properties of the cells of these tumours—the power of producing mucin—and yet retain to some extent their original function of forming zymogen granules within their cytoplasm (*Fig.* 211). Furthermore, the groups of cells referred to in many cases consist partly of cells containing granules, and partly of cells without granules, which cannot be distinguished from the tumour-cells further from the normal gland; these cells are in intimate contact in the same group, and are often arranged so as to enclose lumina filled with mucin, and a careful study of many sections of this part of the tumour

leaves one with a strong feeling that this is a case of the tumour-cells being derived from the secreting cells of the gland. This seems to be the only explanation of the fact that the cells in question are performing normal and pathological functions at the same time.

2. Method of Formation of the 'Cartilage'.—The next point to be considered is the nature of the myxomatous changes in these tumours, and the mode of formation of the so-called cartilage. It is proposed to consider these together, as they appear to be intimately connected with each other.

Several sections from each tumour were stained with Mayer's mucicarmine, and a substance which stained deeply with this was found abundantly in most of them. This substance is most prominent in the less cellular parts of the tumours, where it forms the intercellular substance filling up the spaces between the scattered cells or groups of cells. It has already been described in the account of the structure of a typical parotid tumour, but mention may be made here of the fact that it varies greatly in the intensity of its staining reaction with mucicarmine. In most cases it stains well, when it frequently has a fibrillar structure; in some cases the staining is not so intense, and here it often presents a more homogeneous appearance, showing no definite microscopic structure. This substance appears to be the product of some change in the cells of the tumour, and the problem before us is to endeavour to find out something about its origin and mode of production.

The first tumour which appeared to throw light on the problem was one containing large amounts of mucin, all of which stained very intensely with mucicarmine. Most of this mucin is found enclosed in rings of cells, representing either cyst-like spaces or small tubules. But on careful examination with high powers it was found that many of the cells showed a vacuolated appearance of their cytoplasm, and in these vacuoles, which varied in size from minute points to spaces considerably larger than the nuclei of the cells, there was generally a globule of mucin. This globule did not entirely fill the space, but around the margin of the vacuole, apparently adhering to the cytoplasm of the cell, there was a ring of mucin. This appearance, shown in *Fig.* 212, A, B, C, was observed in many places in three of the tumours, and less frequently in several more. The whole appearance is very striking, and strongly suggestive of a secretion of mucin into intracellular vacuoles. As the amount of mucin increases, the walls between neighbouring vacuoles become thinner, and they coalesce, forming larger spaces; in this way may be formed many of the large spaces containing mucin which are seen so frequently.

There is another appearance very similar to the foregoing which is met with occasionally—the presence of a number of small granules of mucin in the cytoplasm of the cell. It is possible that this may be an earlier stage of the vacuole formation, the mucin appearing first as fine granules, which later coalesce to form one large intracellular globule of mucin.

This formation of large cyst-like spaces bounded by one or more layers of cells and containing mucin must not be confused with the presence of mucin in the lumina of the duct-like structures previously mentioned. These structures so closely resemble ducts that it appears very unlikely that they are formed in the manner just described. In the instances where their lumina

contain mucin, this may either have been secreted by the layer of columnar cells, or else poured into the lumen from other spaces with which they are in communication. It has not been possible to demonstrate the existence of such communication, and from the fact that there is generally a layer of mucin applied to the wall of the duct, it seems probable that it is a true secretion on the part of the cells.

A fourth method of formation of mucin has been observed in some tumours—an extracellular formation of mucin. In some of the more cellular parts of the tumours, if the solid masses of cells are examined, it is found that the cells have the appearance of being slightly separated from each other,

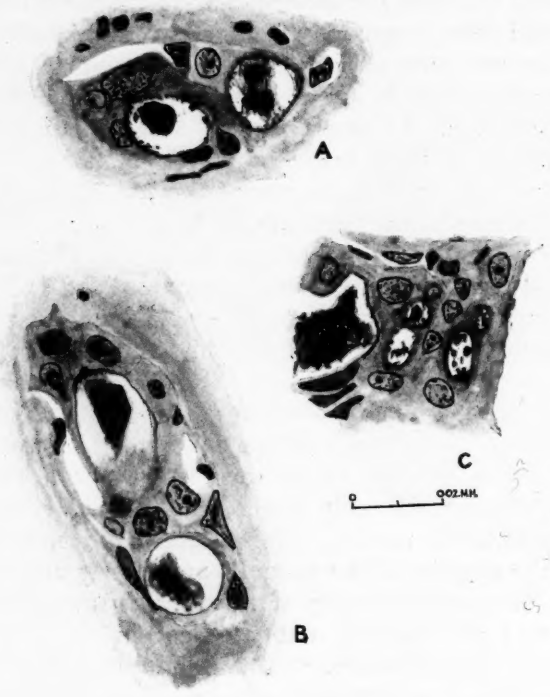

FIG. 212.—Adjacent portions of one section showing (A, C) intracellular vacuoles of varying size containing mucin, and (B) commencing breaking-down of the wall of a large vacuole.

and the space between adjacent cells is filled with fine fibrils of mucin. The appearance is very similar to that of the 'prickle cells' of squamous epithelium, except that the fibrils are not so regularly arranged as in the case of the prickle cells, and they stain deeply with mucicarmine.

A difficulty arises in attempting to determine whether this mucin formation, so characteristic of the salivary-gland tumours, is purely a pathological process, or whether it has any counterpart in the activities of the normal gland. In the submaxillary, many of the acini are composed of mucous cells, but in the parotid, from which the majority of the tumours are derived, no mucous cells are present in the human subject, according to all histologists. It so happened, however, that concurrently with the examination of these

tumours, a number of normal parotid glands, obtained from the post-mortem room, were also examined, in the hope, which was unfulfilled, of finding an early tumour which had not reached a sufficient size to have been diagnosed clinically. It was found that, though no mucous cells were to be discovered

FIG. 213.—Section showing mucin in both fibrillar and homogeneous forms.

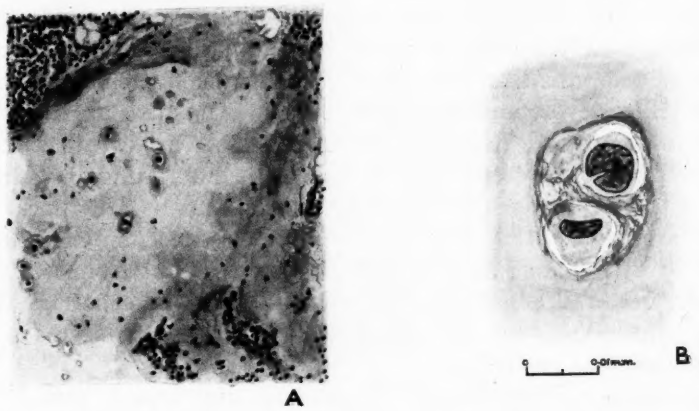

FIG. 214.—To show (A) Fully formed patch resembling cartilage (low power); (B) High-power view of two cells from A, showing the fibrillar mucin causing the appearance of a 'capsule'.

in the secreting cells of the gland, it occasionally happened that a few cells forming the walls of the ducts contained a small intracellular globule of mucin. Such cells are not very numerous, but they are sufficiently so to indicate that the formation of mucin may be one of the normal functions of the cells of the ducts of the parotid. If this is admitted, the formation of mucin by the

tumour-cells may be looked on merely as an exaggeration of a normal process instead of the taking on of a new function by the cell.

The mucin in the tumours, then, is formed in these four ways; as the amount produced increases, changes take place, the nature of which depends on whether the secretion is intra- or extra-cellular. When extracellular, the cells become more widely separated as more mucin is produced; when, however, the secretion is intracellular, the vacuoles become larger, more and more coalesce, and ever-increasing spaces filled with mucin are formed. In the breaking down of the walls between vacuoles, one or more cells often become separated from the main mass of cells and come to lie loose in the mucin, until, finally, large areas of mucin are formed, containing numbers of isolated cells or small groups of cells scattered throughout them.

As a patch of mucin increases still more in size, a further change often takes place. Towards the centre of the patch it loses its fibrillar structure and gradually becomes more homogeneous in appearance; at the same time it stains more faintly with mucicarmine. It tends to shrink away from the isolated cells scattered through it, leaving them lying in small vacuoles; round the periphery of these vacuoles the mucinous material is often more condensed, and takes the stain more deeply. It is this appearance which has been described as cartilage, and at first sight the resemblance is so close in some cases that one is almost irresistibly drawn to the conclusion that it is cartilage. It is only by following out the way in which it is produced that a correct idea of its nature can be formed. We have seen the formation of large areas of mucin, produced as a secretion by the tumour-cells; the transition from this to the homogeneous material, the matrix of the so-called cartilage, is not sudden, but gradual, and it is clear from the sections examined that this matrix is derived from the mucin, probably by some change in its chemical composition. *Figs.* 212–214 are drawings from neighbouring parts of the same section, and they show most of the stages in the formation and subsequent development of the mucin. It has been mentioned that the final product of this development cannot be distinguished in many cases from the matrix of cartilage, either by its microscopic appearance or its staining reactions. But the difference lies in the fact that it undoubtedly begins life as mucin, and only comes to resemble cartilage at a later period, after it is present in large quantities, and as a result of some chemical change. What the nature of this change is, it is difficult to say; but from the fact that the cartilage-like material is almost always found near the centre of the mucinous areas, and that vessels are not found in these areas, it seems probable that it is due to deficient nutrition.

The presence of the ring of deeply-staining mucin round the isolated cells, giving rise to the appearance of a capsule, would seem to be due to the fact that each cell continues to secrete mucin around itself, and this ring represents the part that has not yet undergone the change into the less stainable form. This appearance is shown in *Fig.* 214, where B is a high-power view of the small pair of cells seen in the low-power view, A. The gradual transition from the deeply-stained to the less-stained part should be noticed; nowhere is there a sudden change from the one to the other.

One further point with regard to the staining reaction of this mucinous

material should be mentioned. Fraser, in the paper previously referred to, states that he used cresyl-violet as a differential stain for the matrix of cartilage, and found that the intercellular substance in the salivary-gland tumours stained with this similarly to the matrix of cartilage. If, however, a section known to contain mucin and no cartilage, such as one of a normal submaxillary gland, be stained with cresyl-violet, it is found that once again the staining properties of mucin closely resemble those of cartilage. This stain is therefore of no assistance in determining the cartilaginous nature of this substance.

As a result of these observations, it would appear that in the tumours of this series cartilage does not exist. There is in many places a tissue closely resembling cartilage, but the cells in it are epithelial cells, derived from the other epithelial cells of the tumour, and the matrix is a degenerative product of the mucin which is formed by an exaggeration of a normal function of the epithelial cells.

THE ATYPICAL TUMOURS.

It now remains to discuss the nine tumours which have not been included in the group of 'typical mixed tumours', and to endeavour to bring them as far as possible into line with the others. In all these cases except one, the reason for omitting them from the list of typical tumours was the absence of any of the large areas of mucin containing scattered cells, which by secondary changes give rise to the so-called cartilage. It is proposed to divide these nine tumours into three groups for convenience of description.

Group 1.—This includes three tumours. Two of these present a great similarity in their microscopic appearance. Both consist mainly of masses of cubical or columnar cells, arranged so as to form large numbers of small tubules. The columnar cells are in some cases very high, and in many places more or less perfect representations of ducts are met with. The whole structure is very like the more cellular parts of many of the 'typical tumours', and it is impossible to exclude them from the group of adenomata. In one of these two there is considerable mucin formation; most of the tubules are filled with it, and everywhere the formation of intracellular vacuoles containing mucin is observed. In the other there is no formation of mucin by the cells, except at two places in the sections examined; at these two places moderate-sized areas of mucin are seen, containing scattered cells as seen in all the typical tumours, and at one of these places the so-called cartilage is observed. This serves further to establish the connection between these two tumours and the main group of typical tumours.

The third of this group presents a slightly different appearance, in that the cells are more closely packed together. The tubular arrangement, however, is still very evident, and leaves little doubt of this tumour being an adenoma, similar in all essentials to the preceding two. The resemblance is heightened by the presence of mucin, both intra- and extra-cellular, at one place in the sections examined.

Group 2.—Four tumours are included in this group, on account of one feature which is common to them all—the presence of a large number of mitotic figures. Mitoses are extremely rare in all the other tumours, but

in these four they occur in such numbers as to suggest that they possess some degree of malignancy.

The first of this group is a tumour with a dense fibrous stroma, and consisting of solid and tubular masses of polygonal cells with sharply-defined nuclei as shown in *Fig.* 215. Mitoses are very numerous, and in one or two places in the sections examined, infiltration of the gland substance by the tumour can be seen. No mucin is apparent anywhere, and the growth would appear to be an adenocarcinoma.

The next is a tumour very much more like the ordinary adenoma in many respects. It shows a great deal of mucin formation, both intra- and

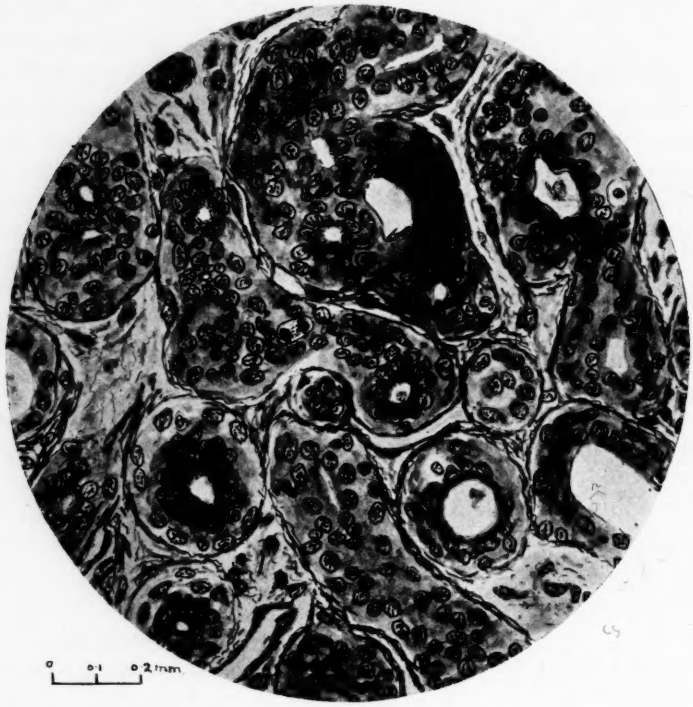

FIG. 215.

extra-cellular. It differs from the adenomata, however, in having a dense fibrous stroma, like the preceding case, and in showing fairly numerous mitoses. These last are not nearly so frequent as in the last tumour, and the growth probably does not possess more than a low grade of malignancy.

The third growth is one which still more nearly approaches the simple adenoma. The cells show the typical tubular arrangement, and there is only a very scanty fibrous stroma. Mitotic figures occur, though not very frequently, and there is no mucin to be seen.

The last of this group closely resembles the first in many ways. It consists chiefly of tubular structures, composed of cubical cells; there is an abundant fibrous stroma, and mitoses are numerous. In addition, infiltration of the gland by the growth may be observed in more than one place.

This tumour, however, shows a copious formation of mucin, which fills all the tubules, and intracellular globules of mucin are also seen everywhere.

Group 3.—This includes two tumours which are put together because they do not fall naturally into the other groups. One is a quite small localized tumour, not more than 15 mm. in diameter, and entirely encapsuled. In a large part it consists of a solid mass of cells of irregular shape, with no definite arrangement, but in other parts the cells take on a columnar shape and are arranged in the characteristic tubules of the adenoma. There is no mucin, and a prominent feature of the tumour is its extreme vascularity. Everywhere there are thin-walled capillaries, many of them extremely dilated and filled with blood, others empty and collapsed. The other requires no detailed description. It is a typical papilliferous cystadenoma, consisting of dilated cyst-like spaces almost entirely filled by papilliferous ingrowths. No mucin is to be seen.

These nine tumours, then, which were classed apart from the 'typical' tumours, show one point in common with the others—their undoubted epithelial origin. They differ from the typical tumours and from each other in two ways—by their degree of malignancy, and by the extent of the secondary changes. The three simple adenomata all show some mucin formation, which is much greater in one of them than in the other two. Only one shows the further changes which lead to the pseudo-cartilage formation. The first of the growths in Group 3 can also be classed as one of these, and this shows no secondary changes whatever.

In the second group we have four tumours, showing similar structure, and all giving some indication of malignancy, greater in some than in others. Two of these show a considerable amount of mucin, and two show none, but this variation is not in proportion to the rapidity of growth as indicated by the number of mitotic figures present. The least malignant of these is probably only in a small degree removed from the simple adenomata, and there appears to be a gradual transition from the entirely innocent tumours to the definitely malignant. Even the most malignant, however, may still show enough of the secondary changes to demonstrate its connection with those tumours at the other end of the scale of malignancy, and it seems probable that all the twenty-five tumours which have been examined, with the exception of the papilliferous cystadenoma already mentioned, have the same essential structure, the difference between them being a difference in degree of malignancy and in the amount of secondary changes.

CONCLUSIONS.

1. The so-called mixed tumours of the salivary glands are not in reality mixed, but are entirely epithelial in origin. They are in most cases derived from the ducts of the gland, but occasionally arise from the secreting cells.

2. The mucinous material which is such a prominent feature of most of these tumours is a true secretion of mucin by the tumour-cells, and this is only an exaggeration of a normal function of the gland-cells.

3. The tumours do not contain cartilage. In the substance which has been described as cartilage, the matrix is formed by a change in the mucin

of the tumour, whereby it loses its fibrillar appearance and its power of staining deeply with mucicarmine; the cells are epithelial cells.

4. Some of the tumours show varying degrees of malignancy; there is no definite dividing line between the innocent and malignant, and some of the more malignant may show many of the features typical of the innocent type of tumour.

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URETHRAL AND PERI-URETHRAL CALCULI.

By G. P. B. HUDDY,

SURGEON TO THE DUDLEY ROAD HOSPITAL, BIRMINGHAM.

It is proposed in this article to deal with stones in the urethra and urethral pouches, but not to include the ordinary prostatic calculi. Urethral calculi are by no means of rare occurrence, but have been neglected in the literature, and especially so in the English-speaking countries, articles being largely composed of records of cases. Bourdillat[1] in 1869 published an extremely interesting thesis dealing fully with the subject, and Englisch[2] in 1903 wrote a long article and analysed 405 cases. In this country Morton[3] in 1906, and Monsarrat[4] in 1912, dealt particularly with stones in the prostatic urethra.

Classification.—The following is the classification adopted :—

A. Urethral.—

1. Formed in the urethra .. .. Primary
2. Formed elsewhere but impacted in the urethra .. .. } Secondary
3. Formed elsewhere but having increased in size in the urethra }

B. Combined.—

1. Urethro-vesical
2. Urethro-preputial

C. Peri-urethral.—

1. Urethral stone which has formed a secondary pouch
2. Stone formed in a previously existing pouch
3. Peri-urethral stone in a cavity which subsequently acquires a communication with the urethra.

Monsarrat[4] considered that the last-named variety might occur in the case of prostatic calculi. Some authors confine the term 'urethral calculus' to a stone actually formed in the urethra—that is, a primary urethral calculus in the foregoing classification—but the definition here adopted is the wider one given by Monsarrat[4] : " The term should be used for all calculi which are lodged in the urethra, whether formed in the urethra itself or elsewhere ".

Causation and Composition.—Primary urethral stones have their origin in the same way as other urinary calculi, the important predisposing factors being : (1) Abnormal constituents in the urine ; these may be due to abnormal metabolic processes or to chemical changes in the urine secondary to infection. (2) Conditions predisposing to urinary stagnation such as urethral strictures, pouches, or foreign bodies. Morton[5] recorded an interesting example of the latter :—

A patient, age 48, had twenty-six years previously used a home-made wooden sound for the relief of retention of urine, and during the process the end had broken off. The stone, which was subsequently removed from a pouched urethra, was found to contain the piece of wood as its nucleus.

The following extraordinary case is recorded by Liston[6] :—

The patient, forty-seven years previous to his application to me, and then about the age of 9 or 10, had incontinence of urine to a certain degree, and was frequently chastised by his parents on account of this occurrence during the night. In order to save himself from a flogging, he one evening, before going to bed, passed a brass curtain ring over the penis as far as he could. This expedient had the desired effect ; but in the morning, swelling had come on to so frightful a degree as to prevent his removing it. . . . The skin under the ring gradually ulcerated ; and as the ring sunk into the substance of the penis the swelling subsided. The integuments met and adhered over the foreign body, and there it remained. . . . On examination a broad hard substance could be felt surrounding the penis close to the symphysis. At the patient's urgent desire, an incision was made upon the lower part of the penis. Immediately on the knife touching the foreign body, the state of the case became evident. The incision was enlarged with a sharp-pointed bistoury, and the calculus . . . extracted. . . . A section has been made of the calculus, and two-thirds of the ring was found in its centre.

Primary stones are usually composed of phosphates, but rarely they may consist of other urinary salts. Secondary stones are of the composition of ordinary urinary calculi, but the deposits accumulated in the urethra are phosphatic in nature.

Situation.—As has been mentioned, these stones are either urethral or peri-urethral in situation. In the case of the former the site of formation or impaction depends upon anatomical or pathological conditions. If the urethra is normal, the stones will almost certainly be of the secondary variety and will be held up at the anatomically narrow parts of the urethra. Common sites are the prostatic portion, the stone being held by the narrow membranous urethra, and the fossa navicularis just behind the narrowest part of the passage. If the urethra is diseased, the stone will be situated in the pathological portion, and, as strictures are common in the region of the bulb, stones are often found there.

Peri-urethral stones are situated in pouches which may be merely depressions of the urethral floor, or in definite pouches having small communications with the urethra. These are found most commonly in the bulb and in the prostatic region in the male, and in the urethro-vaginal septum in the female. As will be seen from the classification already given, the relation of the stone to the pouch is variable.

Case 1.—Male, age 57. Four years previously he had had an external urethrotomy performed. For three years after this there had been no trouble, and then dysuria recurred. Five days before admission the scar had become swollen following cycling. On examination there was a mid-line perineal swelling extending to within one inch of the peno-scrotal junction, with a small hole in the centre which was discharging pus. An incision revealed six faceted stones which were lying in a mucous-membrane-lined cavity situated behind a stricture. Five of these stones are shown in *Fig.* 216. The stones were removed, and later an internal urethrotomy was performed. *Figs.* 217 and 218 illustrate the condition. The stone examined was composed of triple magnesium ammonium phosphate.

Characters.—These calculi may be single or multiple. The single stones are usually ovoid or heart-shaped, and may show irregularities on the surface corresponding to the formation of the urethral wall. Israel[7] reported a case in which the calculi had been formed in the prostatic urethra and

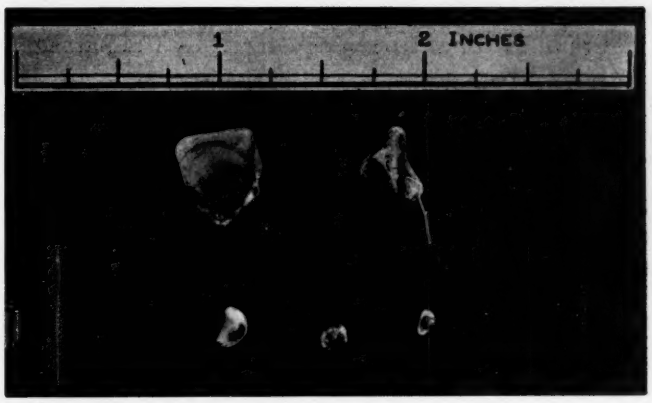

FIG. 216.—*Case* 1. Five stones removed from a urethral pouch.

FIG. 217.—*Case* 1. Shows the elevation caused by a urethral pouch at A, situated at the posterior end of an old external urethrotomy scar, B.

FIG. 218.—*Case* 1. The pouch outlined with lipiodol.

showed a groove corresponding to the elevation of the verumontanum. These stones may at times become guttered by the passage of urine over the surface, and this may progress to a stage of canalization. The urethro-vesical calculi are often of a mushroom shape, the stalk corresponding to the urethra and the bulky upper portion lying in the bladder.

Multiple stones are present in one-third of the cases, according to Finsterer,[8] and such are often barrel-shaped or irregularly faceted. There may be two or more up to a complete chain extending along almost the whole urethra. Monsarrat,[4] in the article already referred to, describes a case of a prostatic diverticulum containing 86 stones; but they may be even more numerous than this, as cases have been recorded in which some hundreds of stones were present. The size is very variable. Bourdillat[1] in his thesis refers to a case of a giant stone, weighing 1450 grm., situated between the prostate and the rectum, the latter being perforated, with the formation of a urinary fistula. The peri-urethral calculi tend to attain a larger size than those within the urethra.

On section a secondary stone often shows the original nucleus, or, if it is formed by the fusion of a number of small ones, more than one nucleus is present. The situation of the nucleus is usually, but not invariably, in the distal end, the secondary deposits having accumulated particularly on the bladder aspect. If the stone has been lying in the cul-de-sac of the bulb or in a wide-mouthed pouch of the floor, secondary deposits may be found on the upper surface with the nucleus in the lower portion. Rarely the mucous membrane becomes lined with a gritty mortar-like material.

Sex Incidence.—As would be expected from a consideration of the anatomical features of the male and female urethræ, and of the rarity of pathological conditions in the latter, calculi are much more common in the male than in the female. Very large stones may be passed spontaneously in women, and Bourdillat[1] refers to the passage of a stone weighing 12 oz., which was followed by urinary incontinence. I consider the following case which has recently been under my care to be of some interest :—

Case 2.—Female, age 27. She stated that for eight years, following an attack of pleurisy, she had suffered from half-hourly frequency of micturition, accompanied by vulval pain. The urine was always thick and sometimes contained blood. On the day before admission retention occurred. The bladder was 3 in. above the pubis, and a calculus slightly larger than a date-stone was palpable in the urethra. Urethroscopic examination confirmed the diagnosis. Whip guides failed to pass, so the stone was crushed with forceps and removed in fragments. An unusual feature of the case was the narrow urethra, which permitted of the passage of the examination urethroscope only with difficulty. The interior of the bladder showed a bald papillomatous type of tumour with a phosphatic covering in the region of the right ureter. There were no other urinary calculi.

Age Incidence.—Urethral calculi are found at all periods of life, and may cause symptoms within a few days of birth. Englisch[2] showed the following figures from 324 cases in which the age was known : 0 to 5 years, 54 ; 6 to 10 years, 38 ; 11 to 15 years, 35. In the ensuing periods of five years the figures vary between 15 and 27 up to the age of 50, after which they become less. According to Finsterer,[8] primary calculi occur most commonly between the

ages of 40 and 50 years. Secondary ones are particularly common in childhood. In 1922 Thomas and Tanner[9] collected 203 cases of urinary calculi in children, and found that in 12 per cent the calculi had become lodged in the urethra.

Clinical Features.—It must be pointed out that there is a marked difference in the clinical features between the primary and secondary stones. The former usually manifest themselves insidiously, and may be latent for many years without giving rise to any apparent trouble. By contrast, the secondary stones give rise to symptoms which are both dramatic in onset and severe in degree, and the fact that a migrating calculus may settle and grow in the urethra has been disputed, for the pain is such that it usually demands prompt removal of the stone.

In Children.—These calculi are almost always of the secondary variety, for in childhood pathological conditions of the urethra are rare, but a deposit of salts has been recorded after an operation for hypospadias. The onset is sudden, the child screaming, straining, gripping at the penis, and passing urine in small drops with marked frequency. These symptoms may be followed by retention, abscess formation, or urinary extravasation. Holmes[10] says: " When summoned to a case of retention, we may almost assume that a calculus will be found impacted in some part of the canal ".

In Adults.—Primary stones give rise to symptoms of varying degrees of severity, such as perineal and penile pain, urgency and frequency of micturition, hæmaturia, and urethral discharge. Dysuria may occur, possibly associated with alterations in the urinary stream, and may progress to complete retention, or the patient may find that by some manipulation or alteration in position the stream becomes free. If the stone is of large size, the patient's attention may be attracted by the presence of a lump. Secondary stones cause severe symptoms. The onset is sudden, pain striking along the penis, often with strangury, which may be followed by a sensation of obstruction or retention of urine. Occasionally there may be a feeling as of something left behind. Stones involving the prostatic urethra may result in incontinence of urine from interference with the sphincteric apparatus, or may cause pain on defæcation.

In some cases the symptoms are intermittent. Annandale[11] described an interesting example in a male of 26 years. The calculi were lodged in a 'cyst' in the prostate and occasionally passed into the urethra, giving rise to incomplete urinary obstruction. Later they returned to the cyst. This culminated in an attack of acute retention, and six stones were removed from the urethra. They were composed of calcium phosphate with some organic material.

The symptoms may be modified by such complications as peri-urethral abscess, extravasation of urine, and epididymo-orchitis. It may be possible to elicit a previous history of renal calculus, litholapaxy, stricture, etc.

Diagnosis.—The diagnosis is as a rule easy, for the stone is readily palpable if the course of the urethra is examined in the penis, perineum, or on rectal examination. Nevertheless the diagnosis is often overlooked until the stone is found on urethroscopy or at operation. This failure is undoubtedly often due to incomplete examination, for palpation of the urethra in

urinary disease is a clinical method not sufficiently stressed, and indeed is often omitted. Further, there is tenderness on pressure over the stone, and a stone crepitus may often be elicited in cases of multiple calculi. The passage of a bougie is usually helpful, as it may be held up by or felt to grate on a stone. This, however, is not infallible, as

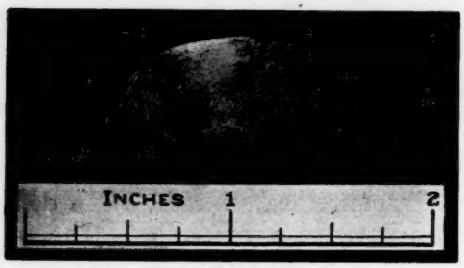

FIG. 219.—*Case* 3. Stone removed from a pouch in the floor of the urethra.

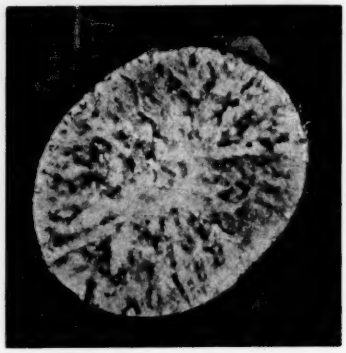

FIG 220.—*Case* 3. Section of stone shown in *Fig.* 219 on a larger scale.

the bougie may fail to pass if a stricture is present, or it may be passed readily even in the presence of a stone as in the case recorded by Morton,[3]

FIG. 221.—*Case* 3. Pouch, with stone, outlined by lipiodol.

in which Lister's sounds were at first passed, but a few days later struck the stone and were held up. A stone lying in a pouch is especially liable to be overlooked. Urethroscopic examination will usually determine the

diagnosis unless the stone is hidden behind a stricture or in a pouch. Finally, radiology may be a valuable aid, particularly if combined with the injection of lipiodol, as this will show the exact relationship of the stone to the urethra.

Case 3.—A male, age 67, was admitted with lower abdominal pain and frequency of micturition by day and night. He had previously had two attacks of retention of urine, but otherwise there was no dysuria. A stone was palpable in the perineum. Urethroscopy showed many folds stricturing the urethra. This stone was composed principally of triple phosphate. *Figs.* 219–222 illustrate the condition.

FIG. 222.—*Case* 3. The bladder and urethra, with the pouch in the floor of the latter.

TREATMENT.

Occasionally the passage of the stone results in a natural cure, but any pathological condition still remains to be treated. Again, in other cases the pressure of the stone causes the formation of a perineal fistula in the male or a vaginal fistula in the female, and through this the stone may escape. *Preventive treatment* consists in dealing with pathological conditions predisposing to the presence of a calculus in the urethra, such as the treatment of strictures, pouches, vesical calculi, etc. Care must be taken after the operation of litholapaxy that no small fragments are left in the bladder.

Treatment is either by emergency or deliberate methods, depending upon the severity of the symptoms. If there is no urgency, a complete investigation of the local and general conditions must be made, e.g., the condition of the urethra, the renal function, and the presence of other urinary calculi.

Minor Methods.—The following minor procedures are of use particularly when small stones are present :—

If urine is allowed to accumulate, the stone may be carried forward on micturition by the increased force of the stream thus obtained. The injection of oil, water, or air, combined with pressure behind the stone, results in dilatation of the urethra, and the stone thus becoming disengaged may be worked forward by gentle pressure with the fingers. In the past the injection of hydrochloric acid has been used with the idea of dissolving the stone.

Bivona's Method.[12]—This was originally successfully carried out by the surgeon upon himself. Preceding the impaction of the stone in the urethra he had had an attack of renal colic, and he considered that as the stone could pass along the ureter it should traverse the urethra and was probably being held by spasm. He injected cocaine to relieve pain and spasm ; then, holding

the meatus, he attempted to micturate, thereby distending the urethra. On releasing his hold the stone was carried forward and passed.

The Filiform Guide Method, used by Jacobs.[13]—This consists in the insertion of a number of filiform guides which become arranged around the stone, then gripping the projecting ends of the guides and withdrawing them together with the stone. I was able to apply this method successfully in a recent case.

Case 4.—A male, age 59, who had previously been operated upon for a malignant papilloma of the bladder, was attending the cystoscopy out-patient department for diathermy of a local recurrence. On Feb. 4, 1927, he complained of having had an attack of dysuria a week previously, followed by pain 'like a needle' in the penis, and a less severe pain at the end of the penis since. The presence of a stone ½ in. within the meatus was confirmed by urethroscopy. As described above, whip guides were inserted, and a number of fragments shown in *Fig.* 223 were withdrawn. The stone was composed of sodium and magnesium carbonates and phosphates.

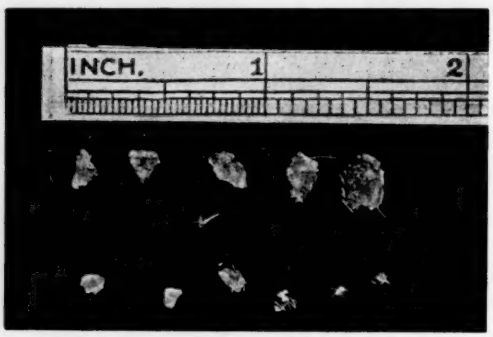

FIG. 223.—*Case* 4. Minute calculi removed by the filiform guide method.

Continuous Dilatation.—If a catheter can be passed, it should be tied in, and following its removal the stone may escape.

The Use of Instruments.—If the above methods have failed, the stone may be removed with the aid of urethral forceps or scoop passed, if considered helpful, through a urethroscope tube, the stone being fixed with the fingers of the left hand to prevent its being pushed back. This applies particularly to stones in the anterior urethra. If the stone is in the posterior urethra it may be pushed back into the bladder and there crushed. Silver wire snares have been employed to encircle the calculus and so remove it. Various types of urethral forceps and lithotrites have been devised from time to time, the latter dating back to very early days.

Operative Procedures.—If the above-mentioned methods fail or are obviously useless, operative procedures become necessary. The simplest of these is a meatotomy to release a stone impacted in the fossa navicularis. For stones situated behind the fossa an external urethrotomy will be necessary. If there is an associated stricture it may be treated at the same or a subsequent operation. If the stricture is solitary and localized, as shown by lipiodol injection, it may be divided by the external urethrotomy or excised. If there is more than one stricture or diffuse contracture of the urethra, an internal urethrotomy is indicated.

Stones in the prostatic urethra may, if large, result in great stretching of the prostate, and this organ may seem to have disappeared. A preliminary examination with lipiodol may be of value in ascertaining the relationship of the stone to the urethra and bladder, and so in deciding whether to approach by the perineal or suprapubic route.

After-treatment.—There is a tendency to recurrence of these calculi. Morton[3] recorded a case in which a patient underwent six operations for the removal of recurrent stones. The dilatation of strictures, the removal of pouches, and investigation of the urinary tract for further calculi must be emphasized in order to prevent recurrence of the trouble. The possibility of atony of the bladder must not be overlooked.

I wish to express my gratitude to the Director, Dr. A. Russell Green, and to the Sister of the Radiological Department.

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A CASE OF COMPLETE GASTRECTOMY FOR CHRONIC ULCER: WITH OBSERVATIONS ON THE EFFECT OF THE LOSS OF THE STOMACH ON THE PHYSIOLOGY OF DIGESTION IN MAN.

By H. B. BUTLER,

HON. SURGEON TO THE ROYAL SURREY COUNTY HOSPITAL, GUILDFORD.

The patient, G. B., age 42, was sent to the Royal Surrey County Hospital on Feb. 12, 1926. He had a four years' history of indigestion, the character of which suggested a gastric ulcer; moreover, an X-ray photograph clearly showed the crater of an ulcer high up on the lesser curvature. There was no hour-glass contraction of the stomach, pyloric stenosis, or obstruction in any part of the bowel.

Fig. 224.—Skiagram taken in the standing position. Second meal in stomach. (Nov. 19, 1926.)

It was agreed that the treatment to be adopted should be complete rest in bed, with the diet and medicines as recommended for gastric ulcer by Robert Hutchison.[1] This treatment was carried out by his own doctor at home and was very successful, the patient gradually making what appeared to be a complete recovery. He remained well until the middle of October, 1926, when the pain returned, though this time it was of a different character, being a continuous stabbing pain made worse by food. He vomited periodically, but there was no visible hæmatemesis or melæna.

His doctor immediately put him back to bed and gave him the treatment which had been successful on the former occasion, but this time with no success, the patient becoming worse. After three weeks of such treatment I saw him again, and he was admitted into hospital. He was very weak and emaciated, but the X-ray examination (*Fig.* 224) revealed the same picture as before, the ulcer being in evidence and still no obstruction. The examination of the blood was as follows: red blood-cells, 3,200,000; hæmoglobin, 75 per cent; colour index, 1·2; white blood-cells, 6560; polymorphs, 75 per cent; small lymphocytes, 14 per cent, large lymphocytes, 9 per cent; eosinophils, 20 per cent.

The low values throughout of both free HCl and the total combined acidity, with the relatively high proportion of bile from half an hour onwards, were, I thought, distinctly in favour of gastric carcinoma. (Dr. Arthur Hurst has since informed me that such a finding is equally common in chronic gastric ulcer.) The long history and, as far as they went, the radiograms were in favour of chronic ulcer. I should certainly have held my hand for further investigation had it not been for the complete inability of the patient to respond to medical treatment, his rapid decline in weight and loss of strength. These circumstances, combined with the analysis of the test meal (*Fig.* 225), made me decide to operate without further loss of time.

Operation (*Nov.* 30, 1926).—A large indurated ulcer was found on the posterior wall of the stomach, near the cardiac orifice. With a finger invaginating the anterior wall into the crater of the ulcer, the edges of the ulcer and the surrounding induration seemed to be irregular and of stony hardness. I felt strongly that the ulcer was malignant and should be removed if possible. Several enlarged and hard glands were felt in the neighbouring gastrohepatic omentum. An opening was made in the gastrocolic omentum to explore the stomach from behind, but the posterior wall was adherent to the tail of the pancreas, so that the stomach above the ulcer could not be examined at this stage. A partial gastrectomy was decided upon.

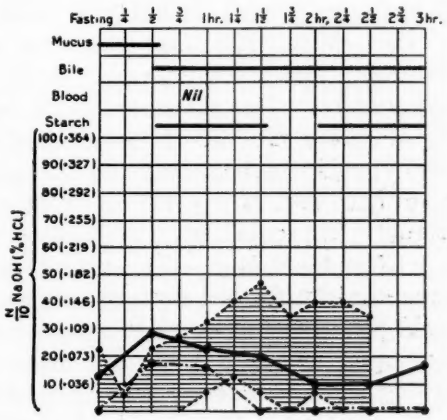

FIG. 225.—Fractional test meal. The shaded area shows the normal limits of free HCl and rate of emptying (2–2½ hrs.).

There is no need to describe the operation in detail. The duodenum was divided just beyond the pylorus, and the stomach freed from its attachments in the ordinary way. The proximal end of the duodenum was closed. The posterior wall was but loosely adherent to the pancreas, and was easily detached without either opening the ulcer or damaging the pancreas. When the stomach involved in the ulcer had been completely freed, it was evident that healthy tissue could not be reached for purposes of anastomosis without encroaching on the œsophagus. The whole organ was therefore removed, and anastomosis was made between the œsophagus and the nearest convenient loop of jejunum. The method of making this anastomosis was as nearly as possible that described by Moynihan. There was no room for the application of clamps on the œsophageal side, and it was apparent that, if this method of retaining the stomach as a tractor until anastomosis is almost complete had not been followed, the anastomosis could not have been made.

One annoying accident occurred which caused some loss of time and undoubtedly increased the shock of the patient. The gastrocolic omentum was divided between forceps, one of which was faulty, and when the omentum was cut there was free bleeding from between the blades of the forceps on the colic side. A ligature was quickly applied around the tissue held in the

forceps, but the blood-vessels had retracted out of the forceps and very free bleeding took place. Attempts to secure the bleeding vessels only made matters worse, so a large hot pad was placed behind the transverse mesocolon and another over the top of the bleeding area, and these were left in position while the operation was continued. After the stomach had been freed these pads were removed and the bleeding vessels were then easily secured. The transverse mesocolon, however, looked rather battered and bruised by the pressure it had been subjected to by the pads, so it was decided to bring the loop of jejunum up over the transverse colon to join with the œsophagus, rather than run the risk of further damage to the mesocolon by making a hole in it.

Pathological Examination.—The operation being completed, an examination was made of the stomach, and it was then thought that the diagnosis of malignancy was probably a mistaken one. The pathological report was to the effect that the condition was one of chronic gastric ulcer with catarrhal changes in the surrounding mucosa. There was no evidence of malignancy. The gastric mucous membrane was injected and had a covering of glairy mucus. It is probable that this glairy covering accounted for the hypochlorhydria, and the chronic gastritis which had caused it may also have had something to do with the failure of the medical remedies to promote improvement.

After-treatment.—The patient was very considerably shocked and caused some anxiety for the first twelve hours after operation. After that he made rapid progress to complete recovery. He soon began to enjoy his food and developed rather a large appetite. He left the hospital on Jan. 31, 1927, having put on more than a stone in weight since the operation. I saw him again on March 25, when he had gained nearly three stone and was anxious to return to his work as a shoemaker.

With a view to avoiding the Addison's anæmia from which four cases of total gastrectomy are known to have died, great care was and is being taken to avoid sepsis from the mouth. All his teeth had been removed before being first seen at the hospital, and he had been provided with well-fitting dentures. He had no discernible sepsis in his mouth or nose, but very strict instructions were given him as to the care of his mouth and dentures, which latter were to be carefully scrubbed with Milton after every meal and kept in this solution at night. On the advice of Dr. Arthur Hurst, he was recommended to take a teaspoonful of dilute hydrochloric acid in a tumblerful of milk, with a little sugar added, three times a day, to compensate for the loss of the normal acid secretion of the stomach and to prevent the contents of his bowels from getting too alkaline and thus promoting the development of bacteria, the toxins of which might cause anæmia. His work, as a mender of shoes, is a dusty and confined occupation, which cannot be the best for him, but it is difficult for a man more than 40 years old to change his occupation. Moynihan's celebrated case, after having his whole stomach removed for cancer, died nearly four years later from Addison's anæmia; and in a case recorded by Ellis a patient developed subacute combined degeneration of the spinal cord and Addison's anæmia in less than two years after a complete gastrectomy had been performed at the London Hospital.

PHYSIOLOGICAL OBSERVATIONS.

In May, 1927, the patient being in apparently good health, the following investigations were made :—

1. **Stools.**—The stools on a full diet were examined for excess of starch, undigested (i.e., striated) muscle fibres, excess of fat, or any abnormal organisms. The report was : A soft pale brown, semi-solid specimen, rather foul. Microscopical examination showed :—

a. Starch granules are only seen in quite moderate numbers and do not constitute an excess by any means.

b. Striated Muscle Fibres are only very little in evidence, and needed much search before one or two small bunches were found.

c. Fat.—The specimen contained 74·6 per cent water. The dried specimen contained :—

			Normal	
Free fatty acids	25·0 per cent	..	9 to 13	per cent
Neutral fats	5·3 „	..	1 to 2	„
Fatty acids present in soaps	7·7 „	..	10 to 15	„
Total fatty extract	38·0 „	..	20 to 30	„

Cultures give no abnormal non-lactose-fermenting organisms.

2. **Barium Meal Investigation.**—The rate of arrival of food at the ileocæcal sphincter and the rate of complete emptying of the ileum were investigated to ascertain whether any portion of the small intestine altered its function at all to become a new stomach.

At 11.30 a.m. on May 6, 1927, the patient was given a breakfastcupful of bread and milk, containing 4 oz. of barium sulphate. An X-ray film taken in the standing position shows a considerable dilatation of the jejunum at its junction with the œsophagus, the jejunum being sucked up under the left dome of the diaphragm, the upper part containing an air-bubble and making a very fair imitation of the fundus of the stomach : the barium meal rapidly circulating in iliac coils (*Fig.* 226). Five minutes later the distended portion of the jejunum still contained a mass of barium, the air-bubble still being much in evidence (*Fig.* 227).

One hour after the meal the barium had all accumulated in pelvic coils of the ileum (*Fig.* 228). An hour and a half after the meal the barium was still all in lower iliac coils (*Fig.* 229). Three, four, five, six, and seven hours after the meal no barium had appeared in the cæcum (*Figs.* 230–233). The patient, being now very hungry, was allowed to have a normal meal. At 7.30 p.m., eight hours after the barium meal, nearly the whole of the barium was in the cæcum, peristalsis having, no doubt, been stimulated by his much-desired meal (*Fig.* 234).

Twenty-eight hours after the barium meal, the patient having in the meanwhile passed a stool containing barium, the colon was still faintly marked out with barium (*Fig.* 235).

3. **Bacteriological Examination of Jejunal Contents.**—A clear bile-stained mucoid fluid with a good deal of white froth was withdrawn by means of Ryle's tube, and cultures on agar plates were made. Some short

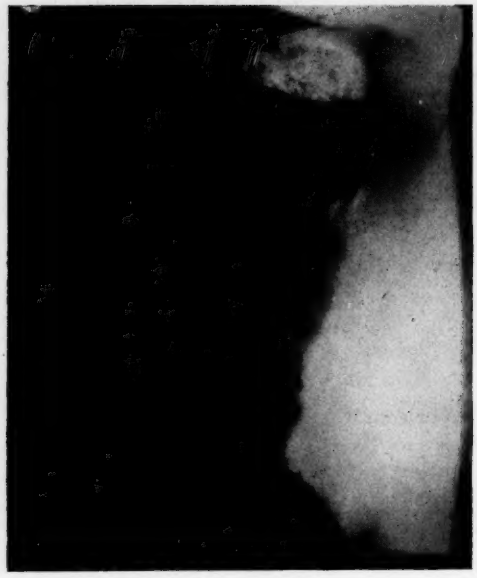

FIG. 226.—Skiagram taken immediately after drinking barium meal. (11.30 a.m., March 6, 1927.)

FIG. 227.—Five minutes after barium meal.

FIG. 228.—One hour after barium meal.

FIG. 229.—An hour and a half after barium meal.

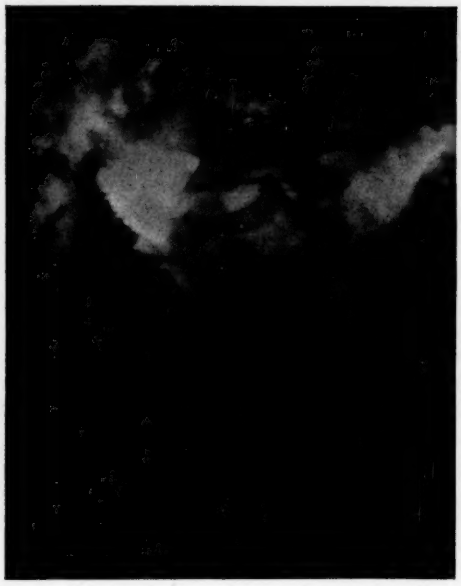

FIG. 230.—Three hours after barium meal.

FIG. 231.—Four hours after barium meal.

FIG. 232.—Five hours after barium meal.

FIG. 233.—Six and a half hours after barium meal.

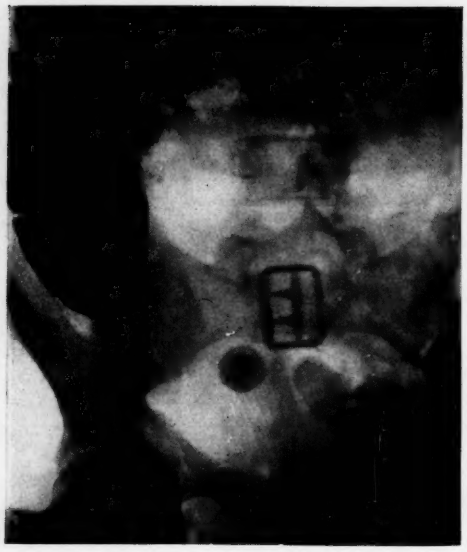

FIG. 234.—Eight hours after barium meal—one hour after eating ordinary food.

FIG. 235.—Twenty-eight hours after early and only barium meal. Normal food taken during day.

fat streptococci were isolated, with a very few colonies of *Bacillus coli*. Broth cultures gave a few streptococci of the same type as above, but were smothered by *Staphylococcus albus*. A few *B. coli* were again recovered.

4. **Blood-count.**—The following is a comparison of the present blood-count with that taken before the operation :—

	Before operation	At present
Total reds	3,200,000	5,433,000
Hæmoglobin	75 per cent	90 per cent
Colour index	1·2	0·9
Total whites	6560	7500
Differential Count—		
Polymorphs	75 per cent	67 per cent
Small lymphocytes	14	29
Large lymphocytes	9 } 23 per cent	2 } 31 per cent
Eosinophils	20 „	1 „
Transitional cells	0	1 „

5. **Defæcation.**—*Does he get his bowels opened as before?* In other words, *Has he got a jejunocolic reflex in place of a gastrocolic reflex?*

For some years before the operation he was very constipated and had no regular time for bowel evacuation. Now he gets an evacuation immediately on rising or directly after breakfast, more frequently directly after getting out of bed, having taken no food or drink; one large soft stool once a day.

6. **Hunger, Appetite, etc.**—He enjoys his meals and is able to eat all ordinary food. If he eats too large a meal, he experiences a feeling of

tightness in the epigastrium. He is quite definitely hungry, and has a feeling of emptiness if he goes without a meal, but he does not get hungry or empty sooner than other people. If asked *where* he feels his hunger, he places his hand over his epigastrium. He is not conscious of any alteration in his sensations of hunger or appetite.

CONCLUSIONS.

It is probable that the improvement in the blood-count as well as in his general health is merely due to the fact that he is no longer losing blood from a chronic gastric ulcer. The loss of the stomach as a machine for mixing, churning, and softening food before it enters the small intestine is apparently not a very serious matter, but the loss of the stomach secretions with their powers of sterilization is of much greater importance. "Knott has shown that achlorhydria not only allows the access of bacteria from the mouth to the duodenum, but, by causing an increase in the alkalinity of the small intestines, it permits bacteria to spread from the colon to the small intestines, the reaction of which normally inhibits their development. The consequent invasion of the duodenum with pathogenic strains of *B. coli* often leads to ascending infection of the biliary passages" (Hurst). It is interesting to note that this man had *B. coli* as well as streptococci in his jejunal contents, and I take this to be an indication to increase his dose of hydrochloric acid.

In answer to the question as to whether any part of the intestine has altered its function so as to become a new stomach, I should say that the portion of the jejunum immediately below the anastomosis with the œsophagus had to some extent done this. There is a decided dilatation which contains a quantity of barium for an appreciable time, and there is a false gastric fundus, developed from jejunum, which performs the duty of the real gastric fundus in accommodating a large bubble of swallowed air during the time when the 'new stomach' is full of food. It is true that the barium remained in the lower iliac coils for an unusually long time, but no dilatation of these coils was noticed, and they immediately emptied themselves into the cæcum when peristalsis was stimulated by taking more food.

The answer to the question whether a jejunocolic reflex has taken the place of a gastrocolic reflex would appear to be 'No', but there is no doubt that taking food into the jejunum sets up a very brisk reaction in the lower iliac coils, corresponding with the normal gastro-ileal reflex of Hurst and Newton. Food which had remained in these coils practically motionless for seven hours was immediately passed on into the cæcum and ascending colon when more food was taken.

So far as the actual digestion of food is concerned, the patient appears to have no difficulty with either starch or muscle, but fat is in excess in his stools, though not to any serious degree. As it is almost all in the form of split fat, it is not likely to be due to pancreatic inefficiency.

It is probable that some food does go in the direction of the duodenum; indeed, I thought I could distinguish two streams of barium descending from the anastomosis when I was watching the descent of the meal through the

X-ray screen; but it is quite certain that a much greater part descends directly into the ileum.

It would have been interesting to have made cholecystograms to see if the bile concentrated normally in his gall-bladder, and particularly if the ingestion of a fat meal caused the gall-bladder to empty itself. At this stage, however, the man became wearied of investigations, and wanted to return to his work. I was obliged to let him go.

My thanks are due to Dr. Arthur Hurst and Dr. R. C. Matson, the former for suggestions as to the nature of the investigations which have been made, and the latter for carrying out all the pathological work.

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SHORT NOTES OF RARE OR OBSCURE CASES

RECURRENCE OF CARCINOMA OF THE STOMACH EIGHTEEN YEARS AFTER PARTIAL GASTRECTOMY.

By ERIC PEARCE GOULD,

SURGEON TO OUT-PATIENTS IN THE MIDDLESEX HOSPITAL, LONDON.

W. B., male, age 58, was admitted to the Middlesex Hospital under the care of Dr. Pasteur in January, 1907, complaining of epigastric pain of four weeks' duration.

Examination revealed a freely movable mass in the epigastrium, to the right of the middle line. The patient's general condition was good, and the diagnosis of carcinoma of the stomach having been made, he was transferred to the care of Sir Alfred Pearce Gould. The following is the record of the operation performed on Feb. 9, 1907 :—

"An incision 6 in. in length was made just to the right of the middle line through the right rectus. The bottom of the incision was ½ in. below the level of the umbilicus.

"The abdominal cavity was opened and a growth was found extending round the pyloric end of the stomach. No glands could be felt. The first part of the duodenum was then clamped in two places, and the gut divided between them. The distal end of the duodenum was closed by a double row of sutures. The coronary and right gastro-epiploic arteries were then ligatured, and the gastro-hepatic omentum and part of the great omentum cut through. Clamps were placed across the stomach well above the growth, and the stomach divided between, the proximal end being closed with a double row of sutures. A posterior gastro-jejunostomy was then done, and the wound closed and dressed with gauze.

"The growth, about 2½ in. in diameter, involved principally the anterior surface of the stomach and did not quite reach the pylorus. It was circular, well circumscribed, and consisted of one large ulcer with a much-thickened nodular base, and thickened everted edges considerably raised above the level of the stomach mucous membrane. The posterior surface of the stomach was only slightly adherent."

Pathological Report.—Spheroidal-celled carcinoma.

Apart from the development of a duodenal fistula, which closed spontaneously, the patient made an uneventful convalescence, and left hospital on March 15.

Nothing further was heard of him until he came to my out-patient department on Sept. 15, 1925, complaining that, having been quite well until February—that is, eighteen years after the operation—he then began to have pains in the stomach and to be short of breath. The man, now 76 years of age, was vigorous but anæmic. Abdominal examination revealed

a soundly healed laparotomy scar, and to the left of it a somewhat indefinite mass which was dull on percussion, moved with respiration, and was not tender. A barium meal gave the picture of a gastro-enterostomy with a small stomach cavity. The blood-count showed a pronounced degree of secondary anæmia. The patient declined to come into hospital, but was seen from time to time, up to December, 1925, without any obvious alteration in his condition.

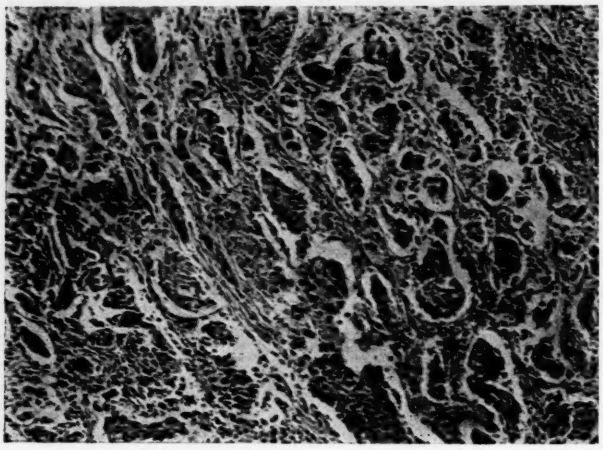

FIG. 236.—Primary tumour. (× 75.)

He was not seen again until June, 1926, when the tumour to the left of the middle line was found to be greatly increased, forming a prominence extending from the costal margin down to the navel, and to the right of the mid-line. He had lost flesh and his anæmia was more pronounced, but he was still taking his food without pain. His chief complaint was of weakness. He was admitted to the hospital on July 15, and slowly sank, dying on Aug. 9. He slept for most of the time that he was in hospital, and on no occasion required sedative drugs for pain. The following is an extract from the post-mortem record :—

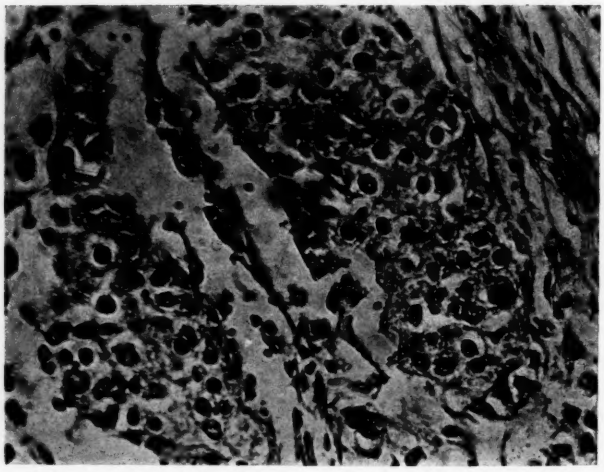

FIG. 237.—Primary tumour. (× 350.)

"Both lobes of the liver were greatly enlarged by numerous soft, secondary new growths, the largest of which was 4 in. in diameter. Previous partial gastrectomy, with gastro-jejunostomy patent. The remaining portion of the stomach was occupied by a large fungating mass of new growth which left little healthy mucosa. The mass of the growth was adherent to the under surface of the left lobe of the liver, and continuous with the deposit in that organ. The head of the pancreas and the middle portion of the body were also extensively infiltrated. The growth within the stomach stopped short at the junction of the jejunal mucosa, which junction was

thus sharply demarcated. Enlarged glands were present in the neighbourhood of the stomach and on either side of the abdominal aorta, but no glandular or other recurrence was found elsewhere in the body."

Sections of the original tumour (*Figs.* 236, 237) show diffuse infiltration of the muscles and connective tissue by columns of spheroidal-celled carcinoma. The cells of the growth have slightly granular protoplasm, and distinct cell outline; the nuclei are fairly constant in size and staining, and each possesses a prominent acidophil nucleolus. No attempts at tubule formation could be detected.

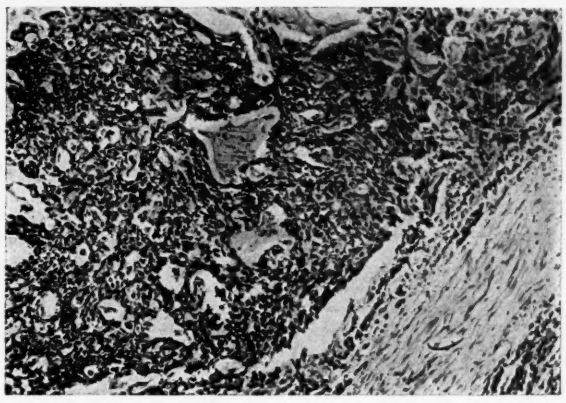

FIG. 238.—Tumour found post mortem. (× 75.)

Sections taken from the edge of the tumour found in the stomach at the post-mortem (*Figs.* 238, 239) show invasion of the surrounding tissue by strands and masses of carcinoma. The cells of the growth have clear protoplasm and indistinct cell outline. The nuclei vary much in size, shape, and depth of staining. The larger nuclei are less densely stained and show a prominent nucleolus. Portions of the growth show attempts at tubule formation.

The difference in the histological character of the two tumours naturally raises the question as to whether the second is a recurrence of the first, or whether the second is not, in fact, a true second primary carcinoma in the same organ. Whilst admitting that the histological differences, although definite, are slight, and would not in themselves justify acceptance of the second of the above alternatives, I feel that the clinical history of the case strongly supports this view. Unlike carcinoma of the breast, in which disease the period of freedom from recurrence not infrequently exceeds 10 or even 15 years, clinical experience suggests that recurrence after removal of a carcinoma of the stomach occurs, if at all, within a 5-year period, although probably few cases of this kind have been followed for as long as 18 years. To this, the most important consideration in favour of looking upon the case as an instance

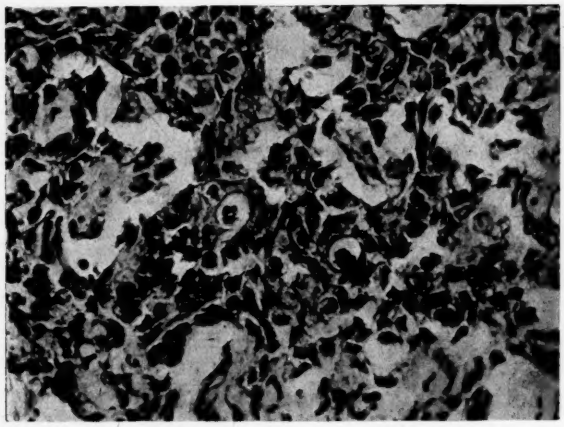

FIG. 239.—Tumour found post mortem. (× 350.)

of a second primary cancer in the same organ, must be added the fact that, whilst the first tumour took the form of a shallow ulcer with everted indurated edges, the second was of the free-growing fungating type.

The chief interest of the case, however, lies in the remarkable prolongation of healthy life which resulted from the operation performed in the early days of partial excision of the stomach. It suggests also the value of an efficient gastrojejunostomy in lessening the pain usually associated with a rapidly advancing gastric carcinoma.

I am indebted to Professor J. MacIntosh and his staff in the Bland-Sutton Institute of Pathology for identifying the block of tissue embedded after the original operation, for cutting further sections from this block, and for reporting upon these and sections made from the tumour found in the stomach post mortem.

A LATE RESULT IN ECTOPIA VESICÆ.

By F. N. G. STARR,

ASSOCIATE PROFESSOR OF CLINICAL SURGERY IN THE UNIVERSITY OF TORONTO.

When I read the notes of the case reported by Drs. Foulds and Robinson,[1] showing the late result in one of the cases of ectopia vesicæ operated upon by the late George A. Peters, it occurred to me that the case of a man living in New York State might also be of interest.

This man, when a boy 11 years of age, had been brought to Dr. Peters' house on the day of the doctor's funeral, having previously experienced in New York City three unsuccessful attempts to make a bladder. The case was referred to me, and on May 11, 1907, I transplanted both ureters into the rectum by the method described by Peters. On the right side the cuff slipped out of the rectum, but the other worked perfectly, and a month later I transplanted the one that had slipped. His condition was not good at this time, and I did not ablate the remainder of the mucous membrane of the bladder, expecting to do that about a year later. He did not return until September, 1916, when I removed the mucous membrane of the bladder, and swung a flap of skin to cover the raw surface.

On May 28, 1926, he returned to see me, having developed a small inguinal hernia on the left side. Except for this he is in perfect health, he has no inconvenience from urine, and his sphincter ani muscle acts perfectly, even during sleep. Another striking thing is that the space between the symphysis pubis has become considerably narrower. He is at this time a young man of 30, carrying on as a commercial traveller, covering the New England States.

REFERENCE.

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A CASE OF OBSTRUCTION DUE TO A MECKEL'S DIVERTICULUM.

By Major C. M. FINNY, R.A.M.C., Malta.

The following case appears worthy of being recorded as it presented several features that were unusual from both a pathological and a clinical standpoint.

J. S., a Maltese soldier, age 19, was admitted to hospital at 5 p.m. on April 26. He stated that he had been seized with severe abdominal pain on the 25th, and had vomited several times. The pain was centred round the umbilicus, but at times involved the whole abdomen. He felt compelled to micturate very frequently, but could only pass a few drachms at a time. There was no distention or rigidity of the abdomen, though he complained of tenderness all over it. His temperature was 98°, pulse 56. He was very restless and noisy during the night; and though he tossed about and once got out of bed, he appeared to find most ease lying on the right side. He vomited several times.

I was asked to see him the following morning. His temperature was still 98°, but his pulse-rate had increased to 94. Breathing was thoracic in character, and all the abdominal muscles were held rigid. He complained of tenderness all over the abdomen, but most marked just to the right of the umbilicus. Immediate operation was advised.

A right paramedian incision was made below the umbilicus, and on opening the abdomen serous fluid escaped. Search revealed a greenish cystic tumour, the size of a small hen's egg, which emitted a foul and fishy smell. It appeared to spring from the superior aspect of the mesentery, not far from its root. It was brought up to the parietal wound with difficulty, when its neck was found to be constricted by a tubular structure about ½ in. broad and resembling a large appendix. The adjacent portion of small intestine was constricted by the same structure, and for a distance of about 10 in. was dilated and of a deep plum colour.

The tube was divided between forceps, with prompt relief to the gut. One end was found to be twisted tightly round the neck of the cyst and to be attached to the ileum about 30 in. from the ileocæcal valve. It was removed from the bowel, and the opening in the latter closed with Lembert sutures. The other end of the tube was traced to the inferior aspect of the mesentery, through which it was found to be continuous with the cystic swelling. The latter, being now free, was removed, and the abdomen closed without drainage. The patient made an uninterrupted recovery.

The Meckel's diverticulum was found to measure 6 in. in length. The free end was bulbous and showed a marked constriction at the junction of its proximal and middle thirds. The portion beyond this was gangrenous.

Meckel's diverticulum is a well-recognized cause of intestinal obstruction, particularly when its distal end is attached to the umbilicus by a cord-like remnant of the vitelline duct. In this case the obstruction was due to the tube knotting itself round the bowel (*Figs.* 240, 241). To do this the free end had first to pass through the mesentery, and then through a loop of itself. The knot formed was tight enough not only to obstruct the bowel, but to strangulate the distal end of the diverticulum.

It seems impossible to account for the position assumed by the vestigial organ on embryological grounds. The vitelline duct is developed before the mesentery and is attached at both ends. It is possible that a developmental defect may have existed in the mesentery through which the free extremity

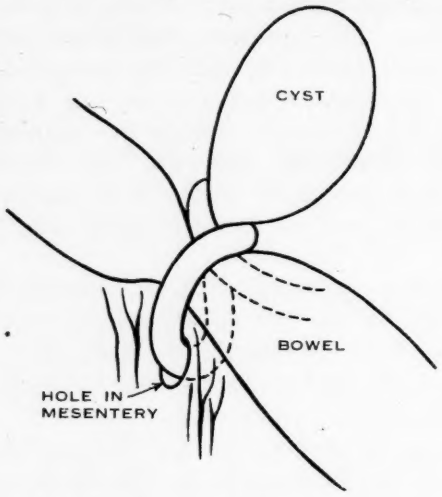

FIG. 240.—Diagram showing relation of diverticulum to bowel and mesentery.

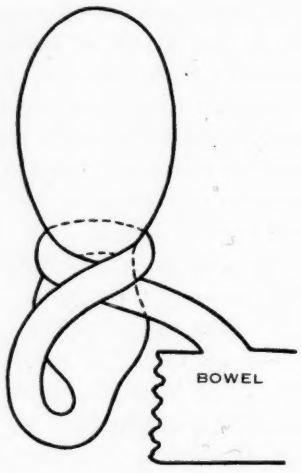

FIG. 241.—Diagram showing knot tied by diverticulum.

of the diverticulum passed, and was assisted by movements of the intestines to assume its final complicated position.

From the clinical point of view, the patient's first symptoms were evidently due to the intestinal obstruction, which was later complicated by commencing inflammation round the gangrenous extremity of the offending diverticulum. His urinary symptoms were probably due to irritation of the ureter at the point where it passed behind the peritoneum inflamed by contact with the gangrenous sac.

It is interesting that even on the third day of the illness there was no pyrexia—a good example of a serious abdominal condition coexisting with a normal temperature.

PERFORATION OF A MECKEL'S DIVERTICULUM.

By J. ALLAN BERRY, New Zealand.

The strangulation of intestines by a band attached to the tip of a Meckel's diverticulum, and its presence in herniæ, are comparatively common, but cases of acute inflammation due to a foreign body appear to be extremely rare. One of the latest cases recorded is that of Dr. Christopher,[1] of St. Luke's Hospital, where the diverticulum was perforated and the result was peritonitis. The reason why a diverticulum of this sort does not more commonly give rise to trouble is its wide opening into the bowel, an opening which is often the same width as that of the bowel. The following case of this unusual condition seems rare enough to warrant its being recorded :—

F. B., male, age 36, was admitted to the Napier Hospital, New Zealand, on Sept. 4, 1923, as a case of acute appendicitis. His previous health had been excellent. The pain commenced thirty hours previously in the right iliac fossa, and was relieved by hot applications. There was no vomiting, but the patient complained of nausea. On the morning of the day of admission, micturition was accompanied by pain, and the same occurred on defæcation. Temperature normal, pulse about 90.

On Examination there was generalized tenderness over the lower abdomen, most marked at McBurney's point. The cutaneous hyperæsthesia seen in acute appendicitis was well marked. Rectal examination showed tenderness, particularly noticeable on the right side. The urine was normal, and the number of leucocytes was high. A diagnosis of acute appendicitis with some peritonitis was made.

Operation.—On opening the abdomen, seropurulent fluid escaped. The appendix was found to be normal, but an acutely inflamed perforated Meckel's diverticulum was found between two and three feet from the ileo-cæcal junction. This was resected, but as there appeared to be some narrowing of the gut it was decided to resect part of the ileum. This was done, and an end-to-end anastomosis performed. The abdomen was drained for a day or two.

Recovery was uneventful, and the patient was discharged on Sept. 29, a little more than three weeks after admission.

On examination of the diverticulum, which measured about an inch in length, and at its base had about the same diameter, it was found to be perforated by a small piece of wood, apparently a piece of a skewer used for holding meat together.

REFERENCE.

[1] Christopher, *International Clinics*, Series xxxv, i, 67.

A CASE OF DIAPHRAGMATIC HERNIA.

By R. F. JOWERS,

CONSULTING SURGEON TO THE ROYAL SUSSEX COUNTY HOSPITAL, BRIGHTON.

L. E., age 7, was convalescing from influenza, having had some vomiting and pain in the earlier part of the attack. At 1 p.m. on Feb. 9 he was seen by Dr. Fawssett, of Lewes, and was then quite comfortable. The abdomen was examined, and nothing abnormal was discovered. During the afternoon the child complained of 'stomach-ache', for which a carminative draught was given. This afforded no relief; the child vomited after his tea, and the pain became more severe and paroxysmal. Dr. Fawssett was again sent for, and found a definite lump in the abdomen lying to the left of the middle line a little below the level of the umbilicus. He diagnosed probable intussusception. I saw the child with him at 9 p.m. The abdomen was unusually flat, except for a definite tumour behind the left rectus, which was rigid. There was slight tenderness only. Nothing was felt per rectum, and no slime or blood had been passed. The patient's bowels had been open very slightly in the morning, but had acted well the previous day. He had vomited several times. Pulse 100, temperature not raised. Agreeing with the probability of intussusception, I advised immediate operation and had the child removed to Brighton.

At 11 p.m. Dr. Fawssett gave an anæsthetic, and I opened the abdomen over the left rectus, the centre of the incision opposite the umbilicus. A dark mass appeared, which proved to be the upper end of the spleen. The incision was enlarged, and the spleen, attached by a long narrow pedicle containing the vessels, and with its edge anterior, was lifted out and laid on the upper abdomen. The pedicle had been twisted once and a half, but the artery was palpable. It was then found that the stomach and duodenum were greatly distended, and the only bowel visible was the descending colon and sigmoid. On raising the stomach a coil of small intestine was seen, and on gentle traction the cæcum and transverse colon came into view, being drawn from an opening in the diaphragm. The ileum was then traced upwards, and collapsed small intestine drawn from the diaphragmatic opening until the duodenum was reached. The child being in poor condition after influenza, and having been some time under the anæsthetic, no attempt was made to close the opening beyond placing the spleen into its normal position, which was just below the opening.

After some vomiting on the day after the operation, the child made steady progress, and by the end of a fortnight was singing and perfectly bright. On Feb. 25, however, he had severe pain in the abdomen, and the air-entry at the base of the left lung was not so good as that of the right. He lay on his right side, and complained of pain if moved on to his back or left side. The next day he was X-rayed by Dr. Prowse, who reported that coils of intestine could be seen above the diaphragm on the left side.

On Feb. 28, under intratracheal anæsthesia, Dr. Fawssett assisting, the

abdomen was reopened through the previous incision, which was extended upwards, and the left rectus divided transversely below the costal margin. The cæcum was found in the iliac fossa. A very long appendix was clamped and removed, and a suture inserted to anchor the cæcum in position. The stomach and a coil of ileum were adherent to the anterior abdominal wall in the region of the incision. A considerable amount of jejunum was found to have passed through the diaphragmatic opening and was easily drawn back, but some difficulty was experienced in freeing the opening of adherent gastrocolic omentum.

The diaphragmatic opening was found to be well to the left, the chest wall forming the lateral boundary, and situated just above the spleen, which had to be dislodged to reach it. A suture was passed through the edge of the

Fig. 242.—Skiagram showing the condition before the second operation.

opening and the chest wall, and some additional sutures through the phrenico-colic ligament and the diaphragm to close the remainder of the opening. This closure had to be performed very hurriedly, as the anæsthetist reported the child to be very bad and requested me to finish as quickly as possible. The abdomen was therefore rapidly closed. Though somewhat collapsed when returned to bed, the child made an uninterrupted recovery, and there has been no return of any symptoms up to the present time.

The skiagram (*Fig.* 242), for which I am indebted to Dr. Prowse, shows the condition before the second operation.

The ideal approach in a case of diaphragmatic hernia would be through the chest wall as described by Le Quénu, but in view of the very long appendix and mobile cæcum, noted at the first operation, I thought in this case it would be better to reopen through the previous incision.

A DOUBLE GALL-BLADDER REMOVED BY OPERATION.

By CECIL P. G. WAKELEY,

ASSISTANT SURGEON TO KING'S COLLEGE HOSPITAL, LONDON.

Anomalies of the gall-bladder are of rare occurrence, and yet several have been described, from the absence of any to the presence of multiple gall-bladders. From the developmental standpoint one would expect a larger percentage of abnormalities, as the gall-bladder is developed as an outgrowth from the primary hepatic diverticulum; this outgrowth is sometimes bifid, giving rise to complete division into two or subdivision of the fundus. The first recorded case in which a double gall-bladder was removed at operation was that of Sherren, who in 1910 operated upon a woman, age 25, and removed the specimen (No. 561.31) which is now in the Royal College of Surgeons of England. Schachner in 1914 operated upon a woman of 52 for cholecystitis, and discovered a double gall-bladder and drained both sacs.

The case described below is of interest because the smaller gall-bladder contained numerous gall-stones, while the larger one contained none. A preliminary X-ray picture was taken, and demonstrated the presence of gall-stones; a cholecystogram would have been of interest, as it might have shown the outline of both gall-bladders.

History.—Mrs. M. T., age 56, first came to the out-patient department of King's College Hospital in 1923 complaining of 'pains in her stomach' which she had noticed for quite five years previously. The patient was fat and weighed over 15 stone. On examination the abdomen was pendulous and the amount of adipose tissue in the abdominal wall was enormous. There was some tenderness in the right hypochondrium on deep palpation, but this was not very definite. The rest of the general examination revealed a thickened descending colon and a loaded sigmoid colon, which was aggravating some prolapsed internal piles. There was marked oral sepsis, which was treated; numerous roots were removed from the upper and lower jaw and the patient was fitted with upper and lower dentures. The internal piles were treated palliatively and the constipation was corrected. After two months' treatment the patient had lost all her pain, her bowels were acting regularly, and there was no sign of any hæmorrhoids.

Nothing further was seen of the patient until March, 1924, when she again came to the hospital complaining of 'pains in the stomach' which were very similar to the former ones. On examination of the abdomen very little was to be found except some deep tenderness in the right hypochondrium. The patient was given a barium meal. The stomach was found to be normal, and was empty in four hours; the duodenal cap was badly formed and appeared to be pulled in an upward direction, and there was a suggestion of some small outlines thought to be gall-stones; the rest of the alimentary tract was normal. The patient was admitted to hospital on May 3, 1924, and drastically purged for three days, after which an X-ray picture of the gall-bladder area was taken. The skiagram (*Fig.* 243) revealed the presence of numerous gall-stones in a moderately enlarged gall-bladder. The day after

the skiagram was taken the patient began to complain of pain in the right shoulder and was slightly jaundiced; whether the drastic purgation had anything to do with this it is difficult to say.

Operation (May 10, 1924).—Under chloroform and ether anæsthesia the abdomen was opened through the upper part of the right rectus muscle. After incising the peritoneum and retracting the rectus muscle, the fundus of the larger gall-bladder presented at the bottom of the wound. On placing the right hand inside the abdomen the smaller gall-bladder containing

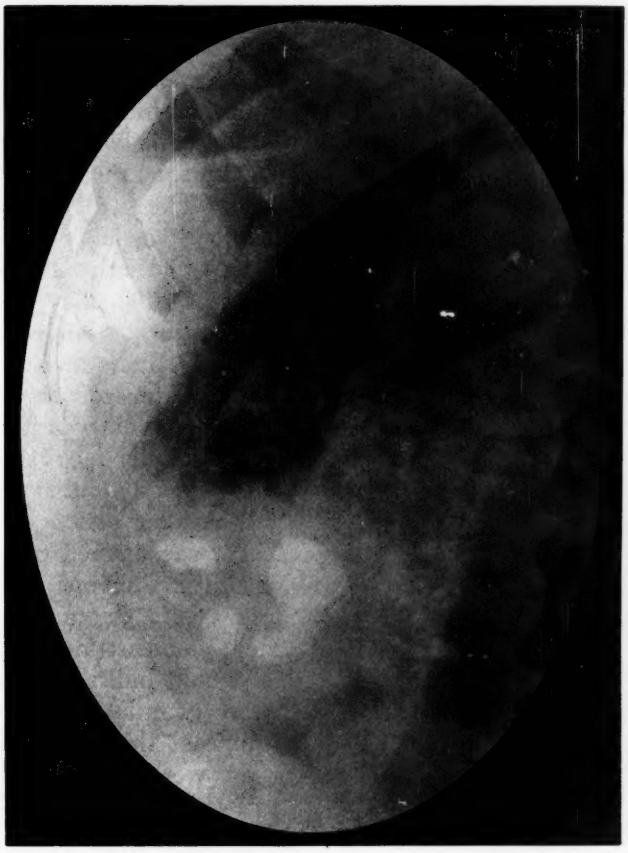

Fig. 243.—Skiagram of double gall-bladder, showing numerous stones in the smaller bladder.

numerous stones could be felt. At first I thought it was a large diverticulum of the gall-bladder. The general peritoneal cavity was packed off with gauze, and removal of the double gall-bladder was performed. The operation was quite easy; the small gall-bladder was more adherent to the under surface of the liver than was the large, owing to inflammation consequent on the chronic cholecystitis. The cystic duct and artery were ligatured separately; a small drainage tube was inserted down to the gall-bladder fissure and the abdomen closed in layers. The drain was removed after three and the stitches after ten days.

Recovery was uneventful. When seen last in 1926, over two years after the operation, the patient was very well, had experienced no more attacks of pain, and her indigestion had vanished.

The specimen was placed in 10 per cent formalin solution directly after the operation and fixed for six days. The cut end of the cystic artery was isolated and traced by fine dissection up the cystic duct; it was found to divide into two parts about half an inch above the place where the main trunk was ligatured. The branches were distributed to the two gall-bladders. A window was cut into both gall-bladders. The wall of the smaller one was very thickened, and the mucous membrane inflamed (*Fig.* 244). The wall of the larger gall-bladder was only a quarter as thick as that of the smaller one; there were no stones inside the cavity. The stones were removed, and the necks of the bladders incised to demonstrate the relations of the cystic duct. A small calculus was found in the neck of the smaller sac; this was impacted, and was no doubt the cause of the gall-bladder colic. The duct of the larger sac opened obliquely into that of the smaller one, so that there were two cystic ducts for about half an inch, and then a common cystic duct for about half an inch. The two sacs were completely blended over the proximal third of their extent, while they were quite free for the distal two-thirds.

FIG. 244.—Double gall-bladder: window cut in each organ.

It may be thought that this was a variety of bifid gall-bladder, but as two cystic ducts are present I consider that it is a variety of double gall-bladder.

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AN UNUSUAL CASE OF UMBILICAL HERNIA IN AN INFANT.

By ELLIS C. BOWDEN,

ASSISTANT SURGEON TO THE ROYAL VICTORIA AND WEST HANTS HOSPITAL, BOURNEMOUTH.

B. D., age 1 month, was brought to the hospital on May 1, 1927, with what appeared at first sight to be a prolapse of large intestine lying on the skin of the anterior abdominal wall through a rupture of the umbilicus, after a fit of crying.

History.—The history given was that, after the cord had fallen off, the midwife had applied 'blue stone' daily to the navel as it would not heal. Half an hour before admission to hospital the mother had noticed the present condition.

On Examination.—The child was apparently not in pain, had not vomited, and his general condition was very good. On closer examination

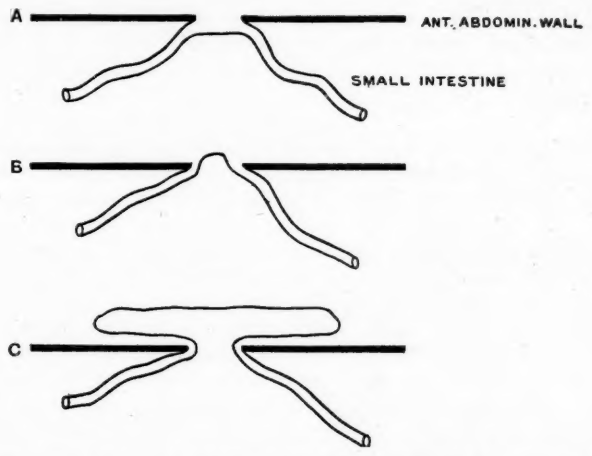

Fig. 245.—Diagram to show: A, Ulceration at umbilicus into adherent small intestine; B, The first stage of prolapse of mesenteric border; C, The prolapse complete, and forming a sac communicating with the general peritoneal cavity.

it was noticed that the mass was bicornuate in shape and attached by a single pedicle protruding about $\frac{1}{4}$ in. beyond the skin level at the umbilicus. Each cornu was about $2\frac{1}{2}$ in. long and 1 in. in diameter, lying at right angles to the pedicle and parallel to the surface of the anterior abdominal wall. Their direction was roughly in the long axis of the body and they were pointing in opposite directions. The pedicle was midway between the tips of the two cornua. The surface was smooth and of dark plum colour.

Operation.—After irrigating the hernia with saline, an incision was made just to the left of the pedicle and the peritoneal cavity opened. Coils of normal small intestine were seen entering the pedicle and filling the two cornua. These coils were reduced, and when the last coil had come through a fold of mesentery was seen passing up into the pedicle. The pedicle was

gently freed from the surrounding abdominal wall, and when this mesentery was pulled the sac of the hernia everted, leaving a dilated segment of small intestine with an opening on its antimesenteric border large enough to admit an ordinary pencil. This opening was closed transversely by two layers of Lembert sutures, and the abdomen closed.

The infant made an uninterrupted recovery except for a subcutaneous abscess at the site of the incision. Unfortunately he developed acute gastro-enteritis six weeks later and died.

The explanation of this condition is, I think, that the application of the copper sulphate had gradually destroyed the abdominal wall at the site of the umbilicus. A coil of small intestine became adherent as a result of the local irritation, and eventually the caustic had destroyed one wall of the adherent intestine (*Fig.* 245, A). The mesenteric border then prolapsed through the opening (B), with its mucous membrane on the outer surface. Finally, it dilated as the coils of small intestine passed into this sac, and formed the bicornuate mass (C).

There was no question of a Meckel's diverticulum, as there was no suggestion of a stump, and apparently the coil involved was too far from the cæcum for this, nor had there been any previous discharge, fæcal or otherwise.

REVIEWS AND NOTICES OF BOOKS.

The Treatment of the Acute Abdomen, Operative and Post-operative. By ZACHARY COPE, B.A., M.D., M.S. (Lond.), F.R.C.S., Senior Surgeon to Out-patients, St. Mary's Hospital, etc. Pp. 238, with 146 illustrations. 1926. London: Humphrey Milford. 10s. 6d. net.

THIS book is a companion and a complement to *The Early Diagnosis of the Acute Abdomen*. It is written mainly for the guidance of the practitioner who, though not generally practising surgery, may occasionally be called upon to treat a case of an acute abdominal catastrophe.

The first chapter is devoted to the description of the instruments and dressings likely to be wanted when operating on cases of this type. It contains many clear drawings of instruments and appliances generally used. The author favours the use of catgut generally as opposed to silk and thread. This more especially applies to cases dealt with in this book, as most of them have at any rate an element of sepsis, and for that reason unabsorbable materials are better avoided. The section on the thorough preparation of the hands, even when rubber gloves are worn, is of the greatest importance, and raises a point which is not always appreciated by surgeons whose operative experience is limited.

The opening sentence in the chapter on the treatment of acute appendicitis is one with which we thoroughly agree and which cannot be too strongly emphasized. If this advice is followed, many lives will be saved and prolonged illnesses due to an appendix abscess will be avoided.

Under the heading of 'Anæsthetics' the contra-indications to the use of chloroform in children are given. We would rather have seen, in a book of this kind, the indications, if there be any, for the use of chloroform for any patients suffering from a septic condition such as acute appendicitis. The removal of the appendix in cases of abscess only if it can be done without much disturbance of the surrounding parts is good advice. Many cases must have died as a result of the removal of an appendix from the wall of an abscess when simple drainage with perhaps removal of the appendix later would have led to recovery. In the same way rectal drainage in suitable cases is not performed as often as might be.

In the chapter on perforated gastric and duodenal ulcers the question of abdominal irrigation is discussed, and the author says that he has not seen many cases in which he thought it advisable. The general feeling is, we think, against irrigation. The number of cases, too, requiring drainage is undoubtedly diminishing. Gastro-enterostomy should only be done in cases in which the condition of the patient warrants a prolongation of the operation. It is by no means always necessary for his future comfort, as many ulcers which have perforated and have been sutured give rise to no further trouble. As the book is specially written for practitioners who have not had great experience in abdominal work, we think it is better to advise against gastro-enterostomy in these cases.

In the chapter on acute intestinal obstruction the danger of the aspiration of foul vomit into the airways is emphasized. This risk can be greatly diminished by washing out the stomach before the administration of the anæsthetic in all cases in which there is severe vomiting.

The chapter on acute cholecystitis is well illustrated by useful diagrams. The operation of partial cholecystectomy, though rarely called for, is one of considerable use in certain cases. We do not think that the advice to operate at the earliest convenient time on cases of acute cholecystitis will be generally accepted. The

condition is hardly comparable to acute appendicitis, as perforation and gangrene are far less common in the former than in the latter. Moreover, operation on an acutely distended and inflamed gall-bladder, frequently surrounded by thin bleeding adhesions, is a formidable undertaking, and the very great majority of these cases will quieten down without operation and may then be operated upon with much greater safety in the interval period.

The chapters on after-treatment, and especially those on diet and the care of the bowels, are among the most useful in the book. After-treatment is, unfortunately, usually neglected in the average text-book. It is a most important subject, especially to the practitioner who may be left to take care of the case after the surgeon has operated upon it.

We can recommend the book to all practitioners who may be called upon to operate in an emergency, and to house surgeons and junior surgeons, who will undoubtedly find many useful hints and much valuable guidance in its pages.

The Early Diagnosis of the Acute Abdomen. By ZACHARY COPE, B.A., M.D., M.S. (Lond.), F.R.C.S., Senior Surgeon to Out-patients, St. Mary's Hospital, etc. Fourth edition. Pp. 237 + xiv, with 30 illustrations. 1927. London: Humphrey Milford. 10s. 6d. net.

THAT four editions of this work have been issued in the last six years shows that the book has proved of both value and interest to many readers. The present edition contains a new section dealing with mesenteric thrombosis and embolism which was omitted from the former ones. Although this condition is rare, it does occasionally occur and is only exceptionally diagnosed correctly before operation. We would have welcomed a little more help in this direction.

There are two new diagrams in the fourth edition, one showing the sites of pain referred to the back of the body in acute abdominal conditions, and the other the different positions in which appendix abscesses may occur.

We are still in disagreement with the author's 'stage of primary shock' in cases of perforation of a duodenal ulcer. We have yet to see a case of perforation of a duodenal ulcer which in its earliest stages shows a rapid pulse and lowered blood-pressure. If this stage does occur at all, it must certainly only last a few moments; we have never seen it persist for an hour or two. Apart from this the principal symptoms of acute abdominal disease are clearly outlined, and the book must have already proved of very great assistance to many who have to deal with these formidable cases.

The letterpress is clear, and the diagrams are devoid of all unnecessary elaboration. It is a work that can be thoroughly recommended to all who are likely to be called upon to deal with cases of this kind.

The Operations of Surgery. By R. P. ROWLANDS, O.B.E., M.S. (Lond.), F.R.C.S., Surgeon to Guy's Hospital, and Lecturer on Surgery to the Medical School; and PHILIP TURNER, B.Sc., M.S. (Lond.), F.R.C.S., Surgeon to Guy's Hospital, and Lecturer on Surgery to the Medical School. Seventh edition. Medium 8vo. Vol. I, pp. 1046, the Upper Extremity, the Head and Neck, the Thorax, the Lower Extremity, the Vertebral Column; Vol. II, pp. 896, the Abdomen. With 900 illustrations, 43 in colour. 1927. London: J. & A. Churchill. £3 10s. net.

IT is some years since this well-known work was revised, though reprintings have been called for. The original Jacobson and Rowlands satisfied a want in a way which no other book has quite succeeded in doing since. It immediately became the stand-by of the active surgeon in the early years of his career, and a book of reference for the more experienced in which he could read the actual accounts of some of the rarer operations which have been performed. It was this general plan of describing real cases which added so very much to the interest of the book and enhanced its

value. The present authors have striven to maintain the unique characters of the original book whilst bringing it thoroughly up to date. They have had before them an exacting ideal, but have succeeded in approaching it very nearly. There are a few imperfections but no gross faults. In the realm of orthopædics there are, in spite of the authors' statements in the preface, numbers of operations described which the general surgeon is seldom called upon to do, whilst others, possibly more frequently required, are omitted. It would have been well worth giving as much attention to orthopædics as to other operative measures.

The critic reading the book gets an impression now and then that the authors occasionally get their values wrong in their selection of what to include and what to expunge. It is interesting to read Matas' account of ligation of the abdominal aorta, and there was no other way of referring to this rare operation than to quote the original author in full; but, on the other hand, the description of interventions upon the pituitary is inadequate. Such operations are more frequently required than the former, and do bring considerable relief to the patient. Eight pages are given over to methods of nephropexy—surely too liberal an allowance for such a rarely performed operation. Too much space also is devoted to operations for fixing the prolapsed stomach and intestines. This section could well have been left out altogether, or only mentioned to be condemned. Lymphangioplasty by silk threads is described fully and figured, though the procedure is generally admitted to fail in its achievements and is not now performed, whereas Kondoléon's method, from which more can be expected, has been omitted. An account of transfusion by defibrinated blood seems called for. It is the simplest of all methods. The statement that removal of the prostate by the perineal route is more likely to be piecemeal than by the suprapubic is not correct—in fact just the opposite is the case. But the authors sum up very fairly and judicially the merits of the two operations. This may be said with added emphasis of the account of excision of the rectum for carcinoma. They argue very fairly upon the relative merits of the different methods, and we think present the position most justly. The illustrations are on the whole very good, though it is easy to pick out some, such as *Figs.* 232 and 255, which do not truly represent the appearances the surgeon actually meets at his operation. Pure diagrams as a rule are much more useful than attempts at realistic art.

Such small blemishes and other small omissions are of little consequence. The general character of the book has been preserved. It remains the best guide we know of for the less experienced surgeons, and in its new form is likely to make as wide an appeal as ever. We congratulate the authors on the strikingly successful fulfilment of a very onerous task.

The Science and Practice of Surgery. By W. H. C. Romanis, M.A., M.B., M.Ch. (Cantab.), F.R.C.S. (Eng.), F.R.S.E., Senior Surgeon in Charge of Out-patients and Teacher of Practical Surgery, St. Thomas's Hospital; and Philip H. Mitchiner, M.D., M.S. (Lond.), F.R.C.S. (Eng.), Surgeon in Charge of Out-patients, Teacher of Operative Surgery, and Demonstrator of Anatomy, St. Thomas's Hospital. Royal 8vo. Vol. I, General Surgery, pp. 795 + viii, with 666 illustrations; Vol. II, Regional Surgery, pp. 955 + vii. 1927. London: J. & A. Churchill. Per vol., 14s. net.

As one might expect from the school from which it comes, this is a good book—one had almost said a very good book. Criticisms, naturally destructive, must be those of minor points, for to a degree which is remarkable in a book written by more than one author, the general balance of space in proportion to the clinical importance of the subjects dealt with is unusually good. The make-up of the book is novel, for the first volume opens with a chapter on general surgical procedures; we trust that in future editions this will be enlarged—for instance, post-anæsthetic vomiting is dealt with in a few lines; if worth mentioning at all, it is surely worthy of discussion with some regard to the differential diagnosis of its causation and significance.

Page 41 contains two unnecessary figures showing how to invaginate the appendix stump, for there is a similar figure in Vol. II, but surely both are unnecessary

if the authors are acquainted with the much simpler and easier method of doing this by an N-stitch. In spite of a fairly wide experience of malignant pustules, one would never have expected that the three figures on page 87 are meant to suggest this disease; the fact that its normal course is toxæmic, and that when it becomes septicæmic in type the outlook is extremely grave, is not sufficiently insisted upon.

There are some chapters which are distinctly superior in level to those of the average surgical text-book. In this category we would place that on injury and diseases of the nerves in the first volume, and that on appendicitis in the second. Indications for operation on acute appendicitis are clearly and logically set out: if in parts the chapter shows a tendency to too frequent classification under headings and numbers, yet stress is laid upon matter of clinical importance, and one does not find long paragraphs devoted to subjects which one has never met with.

We trust that in the next edition, fortified by the success of the first, the authors will have courage to move in the direction towards which they occasionally show a timorous inclination. We suspect that they might have been more drastic had they been less afraid of the publishers, for one still finds whole pages of material dealing with matters which have been history for the last thirty-five years. Did they intend to write a book of practical value on surgery, or did they set out to write a history of surgery? If the former, why mention at all Pirogoff's amputation or all those others which are classified as of historic interest?

Again, much space is wasted on useless diagrams; four of the seven X-rays forming *Plate* 4, two of those forming *Plate* 3, and three of those in *Plate* 1, even to the trained eye convey little of importance. Outline drawings of X-rays would be infinitely clearer. Is not the American tendency to adopt a classification of fractures which conveys some indication as to their position, better than the adoption of such a term as 'chauffeur's fracture'—as a fact we believe that a chauffeur's fracture is usually suprastyloid—and does any surgeon nowadays use the splint depicted in *Fig.* 191?

It is to be hoped that the second edition will omit many of the figures which have no practical pathological interest or of rare diseases, such as *Figs.* 125, 265, 273 in Vol. I; and *Figs.* 50, 170, and 277 in Vol. II, while indicating subjects worthy of illustration, are so indistinct that they need to be redrawn.

Urinary Surgery: A Handbook for the General Practitioner. By WILLIAM KNOX IRWIN, M.D., F.R.C.S.E. Second edition, revised and enlarged. Crown 8vo. Pp. 271 + viii. 1927. London: Baillière, Tindall & Cox. 10s. 6d. net.

THE present volume is an attempt to give "in a concise and lucid form" the essential features of what is usually now known as surgical urology; indeed, in the first edition the work was christened *Surgical Urology*, but in his preface the author states that he has altered this, as "the original title was said to be ambiguous". We are not sure that the change is one for the better, as the name of the second edition seems to be even more ambiguous; we would suggest *The Surgery of the Genito-urinary Tract* as more exact though rather long.

After a description of the anatomy of the parts concerned and a chapter on the examination of the patient, the body of the work is divided into chapters on the principal symptoms likely to be met with in such diseases; this is a very practical method of dealing with the subject, but, unfortunately, it is almost impossible to avoid much repetition; the author thinks that this is an advantage, as it serves to emphasize important points. These are followed by a chapter on the enlarged prostate, and the last four chapters are devoted to operations.

There is a rather striking statement under the heading of cystoscopy: "The adoption of the lithotomy position for cystoscopy is of no advantage to the practised surgeon, involves needless delay and trouble, and causes quite unnecessary distress to many female patients". With the last part of this statement we think many surgeons will agree.

The book is well written, and contains a great amount of information in a very condensed form.

The Enlarged Prostate. By KENNETH M. WALKER, M.A., M.B., B.Ch., F.R.C.S., Jacksonian Prizeman and Hunterian Professor 1911, 1922, 1924, etc. Demy 8vo. Pp. 193 + xi, with 59 illustrations. 1926. London: Humphrey Milford. 12s. 6d. net.

IN this small and readable monograph will be found a very accurate and complete account of our knowledge of the enlarged prostate. One of the author's objects has been "to furnish those who are not experts in genito-urinary methods with a means of bringing up to date their knowledge of this subject"; we may add that those also who have devoted time and thought to these problems will find the book well worth reading.

We fancy that many of our readers will turn with most interest to the chapter on the pathology of this inexplicable enlargement; they will there find an excellent résumé of the various theories that have been proposed, and they will probably agree with Mr. Kenneth Walker when he states that "all that can be said with certainty is that every cause that has yet been suggested is either definitely wrong or else insufficient alone to explain the facts".

There are two chapters which will appeal to those surgeons who have struggled long and unsuccessfully with cases of the 'small fibrous type of prostate'; the one is entitled 'Prostatism without Enlargement', and is an attempt to elucidate the pathology of this condition; the other gives an account of the author's 'Perurethral Operation'; this consists of the destruction of the median bar by diathermy through a special instrument devised by him. In suitable cases he claims a low mortality, a high percentage of cures, and a smooth convalescence.

Tumeurs malignes des Os. By G. NOVÉ-JOSSERAND, Professeur de Clinicale Chirurgie Infantile et d'Orthopédie à la Faculté de Médecine de Lyon; and L. TAVERNIER, Professeur agrégé à la Faculté de Médecine de Lyon, Chirurgien de l'Hôtel-Dieu. Medium 8vo. Pp. 430, with 48 plates in the text. 1927. Paris: Gaston Doin et Cie. Fr. 130.

THIS volume upon the malignant diseases of bone is one of the "Bibliothèque du Cancer" published in Paris under the direction of Professors H. Hartmann and L. Bérard. In its general lay-out plan it follows, in the main, some of the previous volumes of the series which have already been published.

In the chapter which is devoted to etiology some attention is paid to the traumatic origin of cancer, and also to the modern work by Gye and Barnard. This portion of the book, however, is comparatively scanty and is not of much importance. The chapter which is devoted to pathological anatomy is good. As regards the classification which is adopted in connection with the pathological anatomy of malignant tumours of bone, the authors divide them into the following groups: "(1) Les ostéosarcomes; (2) Les tumeurs à myéloplaxes; (3) Les myélomes; (4) Les endothéliomes; (5) Les tumeurs secondaires". This chapter is perhaps the best portion of the volume. The illustrations, however, which are fairly numerous, have not been produced in a style which is equal to that of a good many modern French medical works. This remark refers especially to the reproductions of a rather numerous series of skiagrams. This inferiority in the reproduction of the skiagrams detracts to some extent from the value of the book.

The portion which is devoted to symptomatology is good, but again in this part the illustrations are distinctly poor, or at least the reproduction of the original illustrations is poor. The chapter on diagnosis and differential diagnosis is one of the good chapters in the book, but again the reproduction of the skiagrams is bad. The other illustrations, however, in this section are fairly good.

In the chapter devoted to treatment, operation is advocated as the method of choice. As to whether amputation should be carried out at the proximal portion of a long bone or disarticulation at the proximal joint, the authors seem to think, after a study of published cases and their own experience, that there is not much to choose. Resection of the affected portion of bone and replacement of the removed part by bone-grafts is considered at length. The authors point out that

it has been done by some English and other observers, but that the ultimate result is little affected by this particular form of operation, since a great majority of patients suffering from sarcoma of bone die from visceral growths which are present at the time of surgical operation and cannot be diagnosed in most cases, and, if diagnosed, cannot be removed.

Treatment by toxins, such as Coley's fluid, is discussed, and the conclusion come to from the authors' own experience is that they have not been able to get good results, and they think that the results obtained by Coley in America are much better than anyone has been able to obtain in the same kind of case on this side of the Atlantic.

As regards treatment by radiological methods, they think that radium has not given very good results, and they do not advocate its routine use. They think, however, that treatment by X rays is particularly useful in the round-celled sarcomata, since this variety of growth, in their experience, is very radio-sensitive. They found, however, that spindle-celled forms are not improved by this method of treatment.

The volume concludes with a very good bibliography, mainly Continental.

Exploration clinique et Diagnostic chirurgical. By FÉLIX LEJARS, Professeur de Clinicale Chirurgie à la Faculté de Médecine de Paris. Second edition. Medium 8vo. Pp. 932, with 1094 illustrations. 1927. Paris: Masson et Cie. Stitched, Fr. 100; bound, Fr. 120.

THE author of *Urgent Surgery* has produced another original, voluminous, and probably popular volume. It is not so much a scientific treatise on surgery as one which deals with the art of surgery, and particularly how to examine a patient —how to examine a patient with the eye and the hand, how to palpate, how to percuss, how to measure and compare. Each region of the body is taken separately from the crown of the head downwards, and the technique of examination described for every sort of injury or diseased process. This 'craft' of surgery, if one may so describe it, is in danger of being lost in these days of specialism and ultra-scientific laboratory work, and Professor Lejars does a valuable service to the medical world in stressing the importance of this side of medicine. Most of the men who are ploughed in their final examinations in medicine and surgery come to grief in the clinical section of the examination, and if the cause of failure is analysed, it is found nearly always to be faulty examination of the patient. In order to make a correct diagnosis of a patient, the physical signs must be sought for, and registered accurately. It is just as important to have a correct stance in examining a patient as it is to have a long ball at golf, and so it is worth while giving attention to the craft of surgery and educating our senses to the utmost.

This book, then, deserves well of the medical public, and if its lessons are all assimilated, many fewer mistakes in diagnosis will be made.

Diagnostic des principaux Cancers. By HENRI HARTMANN, with the collaboration of many medical men. Demy 8vo. Pp. 64, with 10 illustrations. 1927. Paris: Masson et Cie. Fr. 10.

THIS is a small book of 64 pages, which consists of reprints of a series of short articles which have already appeared in the *Presse Médicale* and now are brought together and published in book form. These short articles, which describe the early signs of cancer of different organs of the body, are designed to promote an earlier diagnosis of malignant disease, so that patients may be brought to the surgeon at an early stage in the disease.

Pathologie des Ménisques du Genou. By ALBERT MOUCHET, Chirurgien des Hôpitaux de Paris, and LOUIS TAVERNIER, Professeur agrégé à la Faculté de Médecine de Lyon. Medium 8vo. Pp. 100, with 25 illustrations. 1927. Paris: Masson et Cie. Fr. 18.

THIS monograph represents the report presented by the authors to the Surgical Congress in Paris held in October, 1926. It contains a clear and well-illustrated account of the chief lesions of the semilunar cartilages and of the cysts or pseudo-cysts to which they are liable. We have no criticism to offer in regard to the anatomical or pathological aspects of this work; but we confess to a feeling almost of consternation in reading the operative treatment proposed. The authors describe and figure, as the routine operation for lesions of the internal cartilage, one in which a transverse incision is made right round the inner side of the knee in a line with the joint. Through this the internal lateral ligament is divided. Such an incision does, of course, give an excellent view of the whole medial meniscus, but we have always considered that preservation of the internal lateral ligament is an essential necessity of any operation. Probably many of the poor results of meniscotomy are due to the fact that the lateral ligament has been torn or stretched by the original injury, and deliberately to cut this ligament appears to us a most dangerous and quite unnecessary procedure. It is true that the authors describe the careful suture of the lateral ligament as one of the concluding steps of their operation, but everyone is familiar with the fact that the effective suture of a ligament is a most doubtful and difficult undertaking.

Les Cancers du Sein. By PIERRE DELBET, Professeur de Clinique Chirurgicale à la Faculté de Médecine de Paris, Chirurgien des Hôpitaux; and MENDARO, Assistant étranger à la Clinique du Professeur Delbet. Royal 8vo. Pp. 343, with 100 illustrations and 4 coloured plates. 1927. Paris: Masson et Cie. Fr. 50.

THIS book is a record of personal histological and clinical work, mainly directed towards achieving such a classification of breast cancers as will enable a trustworthy prognosis to be given from the histological appearances of a particular case. It also deals with the origin and dissemination of breast cancer from a histologist's point of view, with symptomatology and diagnosis, operative methods, and results. There is a final chapter on non-operative therapy. The book is written in pellucid French which leaves no doubt as to the authors' meaning, and it is enlivened with graphic touches of description, seasoned by an occasional stroke of irony. It should certainly be studied by all who are interested in breast cancer. The authors present many original observations, and are always interesting even when they are not convincing. The illustrations are numerous and excellent, though personally we prefer photographs to histological drawings, however good.

Professor Delbet's main interest in the subject has been to discern a classification of breast cancers which will offer a secure foundation for prognosis. His work, therefore, is on the same lines as the recent work of Greenough, of Boston. As he truly says, "Une classification qui ne permet pas d'établir un prognostic est dépourvue d'intérêt". These words reveal the practical French spirit which guided Pasteur in all his researches, a spirit which desires to be helpful, and which finds in that desire, rather than in the cold joy of pure intellection, the true incentive to scientific work.

Delbet points out, as Bland-Sutton had done before him, that early and apparently favourable cases of breast cancer sometimes do badly, while advanced and ulcerated cases sometimes do well. He set himself to solve this problem. He gives reasons for thinking that the differences in malignancy do not depend upon the qualities of the stroma. He approached the problem by the re-examination of a large number of microscopic specimens of cases with known clinical histories, noting all the peculiarities of each specimen, hoping that these peculiarities might run parallel to those physiological peculiarities of the cancer cell which determine the clinical issue of the case. He claims only partial success in his quest. His classification is based partly on the morphology of the cancer cells, partly on the

presence or absence of invasion of the blood-vessels. Unfortunately, from the theoretical point of view, invasion of blood-vessels is seen, so he says, in 'benign' as well as in specially malignant cases. Contradictory characters, good and bad, may be present in the same case, and a large number of cases prove unclassifiable, as the author regretfully admits. He thus summarizes his conclusions :—

" Les épithéliomes en rognons à rosettes sont bénins, mais ils ne constituent pas une forme achevée de cancer. Je les considère comme une phase évolutive transitoire qui tends vers l'infiltration et la diffusion. Les épithéliomes à cellules claires sont des formes bénignes. Les épithéliomes mégacellulaires et les épithéliomes à cellules indépendantes sont des formes terribles. Voilà tout ce que j'ai pu tirer du rapprochement des caractères morphologiques et des caractères cliniques des cancers du sein. Je dois cependant ajouter que certaines formes d'infiltrations diffuses me paraissent comporter un prognostic grave. Ainsi lorsqu'il y a un grand nombre de plasmodes d'avantgarde pénétrant dans les interstices du tissu conjonctif, dans les nodules lymphocytaires, entre les vésicules adipeuses. Ainsi encore quand il est manifeste que les infiltrations des cellules cancéreuses se plient aux exigences du tissu conjonctif, ce qui indique que ces cellules ont perdu la cohérence et aussi l'adhérence."

It will be noted that the author says nothing about the prognostic significance of the extensive areas of degeneration found in certain carcinomas. We are inclined to think that such areas are of good omen.

In discussing dissemination, Delbet has paid Sampson Handley the compliment of analysing his views at length. He fully admits the existence of permeation. He attributes to Handley the view that the blood-vessels play no part in dissemination, and that permeation is the only means of lymphatic spread. What Handley really maintained is that " the processes concerned in dissemination are mainly three in number : (*a*) permeation, (*b*) infiltration, (*c*) transcœlomic implantation. To these must be added as playing subsidiary parts : (*d*) lymphatic embolism, which leads only to gland deposits, and (*e*) blood-embolism, which is usually ineffective owing to the inability of the cancer-cells to colonize the blood-stream " (Choyce's *System of Surgery*, 1912). These views are still held by Handley. Delbet is a convinced advocate of dissemination by the blood-stream, and he describes a variety of cancer, *cancer lymphophobique*, which, as its name shows, actually hates the lymphatic vessels !

M. Delbet permits himself a little sarcasm when discussing the process of perilymphatic fibrosis which was described in 1904 as destroying the permeated lymphatic and replacing it by a fibrous cord. He says :—

" Cliniquement il y a bien des cas où l'examen microscopique le plus attentif ne révèle aucune continuité entre le néoplasme primitif et les noyaux secondaires, mais ces cas n'embarrassent nullement Handley. Il déclare que la sclérose périlymphatique peut supprimer secondairement la continuité qui a primitivement existé. Cette sclérose périlymphatique, qui écrase doucement les cellules cancéreuses échappe à tout contrôle, et elle a une conséquence très importante, c'est qu'elle rend incontrôlable la théorie de Handley."

He is too polite to add " Voilà son raison d'être ", nor does he refer to the photographs showing all the stages of the process which Handley's book contains, nor to the fact that there have been traced the various degrees of the process up to almost complete fibrosis along the length of the same lymphatic. We beg to assure M. Delbet that Handley's observations on this subject can be controlled and verified by any pathologist who is prepared to take sufficient trouble.

Delbet with Herrenschmidt has reinvestigated, very inadequately, Handley's statement that cancer spreads in the plane of the deep fascia and not in that of the skin. Of the three cases examined, in the first he examined separately three little subcutaneous nodules. In the second he examined a fragment obtained by biopsy, and found a permeated lymphatic in the superficial subcutaneous tissue. In a third case, in which the opposite breast showed incipient invasion, he examined the skin at the edge of an area of peau d'orange, and found permeated lymphatics in the

dermis. In none of the cases did he examine the deep fascia, so far as his book shows. All the cases were inoperable.

Delbet states that in none of these inoperable cases would it have been possible to dissect up a flap so thin that it would not have contained cancer cells. He therefore concludes that Handley's advice to remove only a restricted circle of skin in operable cases is unsound—a very curious *non-sequitur*. In any such work the method adopted must be rigidly topographical and must investigate all the layers concerned. The application of microscopic methods on a microscopic scale and the accurate plotting of the cancerous foci are essential. Only thus can the relative spread of the disease in the skin and the fascia be determined.

Delbet criticizes the plate in which Handley demonstrated the spread of cancer in the fascial plane 25 mm. beyond the farthest point of infection of the skin. He prefers to transfer the contrast to one between the fascia and the deep subcutaneous fat. The latter layer showed an isolated focus within 5½ mm. of the farthest infection of the deep fascia.

It would appear that, after the wide removal of skin which he practises, Delbet only secures coaptation of the edges by metal sutures, which are tightened with all the force of which the operator is capable. Surely this is the breast surgery of an earlier age. Moderate skin removal combined with freer fascial excision permits the flaps to be sutured with thin silk and almost without tension, and experience shows that after such an operation, local recurrence is very rare.

We make no apology for dealing at length with this question, which is of vital practical importance.

The most interesting section of the book is that dealing with dissemination by the blood-stream, a mode of invasion to which Delbet attaches great importance. He thinks it occurs mainly as a local process in the neighbourhood of the cancer by direct infiltration of the cells of the growth into capillaries and arteries. The occurrence of local nodules and their centrifugal spread can thus be accounted for by blood-capillary emboli. It is noteworthy that in 20 out of 21 cases classed as 'hæmophilic' cases there was invasion of the axillary glands, so that, as Delbet states, the 'hæmophilic' cancers are also 'lymphophilic'. To establish his case for blood-invasion, Delbet relies upon a striking series of figures showing cancer cells invading the arterial sheath, infiltrating the arterial wall, lying in a 'vein' and invading the blood-capillaries. All these figures are convincing except *Fig.* 54, where the structure of its wall shows that the supposed vein is a lymphatic vessel. They appear, however, to be all derived from one or two cases. The authors establish the *fact* of blood-invasion in breast cancer, but supply no weight of evidence as to its frequency or efficacy.

Die Chirurgie. A Manual of Surgery. Edited by Professor M. KIRSCHNER (Königsberg) and Professor O. NORDMANN (Berlin). Fasc. 13, Vol. IV, pp. 398, with 410 illustrations and 32 coloured plates. M. 27. Fasc. 14, Vol. VI, pp. 287, with 98 illustrations and 15 coloured plates. M. 18. Fasc. 15, Vol. VI, pp. 238, with 86 illustrations and 2 coloured plates. M. 13. 1927. Berlin and Vienna: Urban und Schwarzenberg.

FASCICULUS 13, which forms a part of the fourth volume of the work, deals with the surgery of the face and the upper and lower jaws, including the teeth, and is written by Professor Klapp, Dr. Franz Bauge, and Dr. Franz Ernst. Dr. Ernst gives a very full description of the developmental errors affecting the lips and hard palate. He lays great stress on the use of obturators in the treatment of palate defects, and describes an operation for complete cleft palate in which the soft tissues covering the hard palate are detached all round the margin of the alveolus, so that the new palate becomes shifted backwards as well and towards the mid-line. He makes no mention of the reversed flap operation, nor does he figure Brophy's method.

The sections dealing with plastic surgery of the face are very well illustrated by partly coloured diagrams which give the detail of many operative procedures; but one misses the full presentation of the tube-flap methods and those which utilize the skin of the chest for restoration of great facial defects. The articles on the

surgery of the jaws are of great value, especially in the description of various appliances by which defects after excision can be made good and deformity prevented. Several very ingenious operations for altering the size of the lower jaw are described and illustrated. The pathological anatomy of the jaw tumours is not given a full enough description, nor is it illustrated as the subject deserves.

The last chapter of this fasciculus is by Professor Beyer, of Berlin, and describes the surgery of the nose and its accessory sinuses. It is characterized by very excellent and clear anatomical illustrations, as well as a good account of the typical operations for the exposure and drainage of the accessory sinuses. The full-page coloured illustrations in this number are not of great artistic merit, but the figures in the text throughout leave nothing to be desired in respect of clearness and accuracy.

Fasciculus 14, which is part of Volume VI, is all by the pen of Professor Wehner, of Köln, and deals with the urinary bladder, prostate, and seminal vesicles. The description of the anatomy of these parts is very clear and well illustrated, but it would have simplified the subject if the anatomy of all three of these closely related regions had been described together, instead of in the two separate sections which introduce each part. The chapters dealing with clinical methods does not call for any special comment, except that the description and illustrations of modern cystoscopes are disproportionately short compared with those given of different types of catheters. Diverticula of the bladder are described in some detail, with many good illustrations. The distribution and character of the pictures call for some comment. No fewer than five figures are devoted to the operation of litholapaxy, and not one to excision of the whole or part of the bladder with transplantation of the ureters. The numerous coloured illustrations are beautifully reproduced, but the original drawings are often rather crude. The chapters dealing with the surgery of the prostate give a very complete account of the pathology and clinical aspects of the subject. The two-stage operation is strongly advocated in removal of the hypertrophied gland. In discussing the factors which decide whether a radical operation should be done, we do not think that the tests for renal efficiency are given sufficient prominence. Further, in dealing with the after-results we think that the common condition of retention of urine from closure of the vesical aperture is not sufficiently emphasized, whilst the comparatively rare possibility of recurrence of the prostatic tumour is fully discussed.

Fasciculus 15, a part of Volume VI, is by Dr. A. Weinart, of Magdeburg, and is concerned only with the spleen and the surgery of the so-called blood diseases. It deals very fully with questions of physiology, discussing the functions of the spleen and the problems of blood formation and destruction. The most valuable part of this section is the full discussion of the blood changes which occur after extirpation of the spleen, both in normal and diseased conditions. The principles and technique of blood transfusion are considered in detail, and the only criticism we can make about this chapter is that perhaps too many and too complicated methods are described. The blood diseases which are discussed are pernicious anæmia, hæmolytic jaundice, Banti's disease, Gaucher's disease, hæmophilia, lymphatic leukæmia, myelogenous leukæmia, and Hodgkin's disease. A summary of the essential nature of these diseases and their reaction to splenectomy or to ligature of the splenic artery is given after the general discussion, and this tabular presentation is most valuable.

Handatlas der Cystoskopie. By Dr. Otto Kneise, Professor of Urology in the Halle-Wittenberg University. Second edition. Pp. 119, with 102 coloured illustrations. 1927. Leipzig: Georg Thieme; London: Henry Kimpton. 42s. net.

The first edition of this work appeared in 1907; the explanation of the long interval which elapsed before the present edition was issued is to be found in the occurrence of the Great War and the subsequent Revolution, which was followed by such a rise in the cost of everything that the publication had to be delayed till prices became more nearly normal.

The atlas in question is, we believe, unique in that all the illustrations are by the author himself; in fact, Dr. Kneise goes so far as to assert that all such illustrations should be painted by the cystoscopist; we doubt, however, whether there are many cystoscopists who could paint as beautifully as Dr. Kneise. The work is not merely a cystoscopic atlas; there are 70 pages of letterpress devoted to a description of the cystoscope and the necessary technique, and to articles on the appearances of the normal bladder, of inflammations of the bladder, of hypertrophy of the prostate and trabeculated bladder, of bladder stones and foreign bodies, of vesical tumours and their therapy, of bladder fistulæ, diverticula, and ureteroceles, and to ureter catheterization and functional diagnosis.

The cystoscopic pictures are beautifully reproduced, and the letterpress is interesting and lucid. We do not think there is anything very new, but there are at least two subjects on which the author seems to us to be breaking new ground. (1) The first of these is a description of 'gangrenous dissecting cystitis', which Dr. Kneise, who was formerly a gynæcologist, had several opportunities of observing; he considers that this form of cystitis is nearly always due to the incarceration of the retroverted gravid uterus, to trauma during difficult labour, or to severe injuries to the bladder during the course of hysterectomy; we think that paraplegia should be added to that list of causes. He presents two most interesting pictures of this condition observed through the cystoscope, one during the acute stage and another very striking one showing the after-result. (2) The second is his description of the various fistulæ which may open into the bladder; amongst them are included some very good pictures of the cystoscopic appearances of implanted ureters; this subject is usually neglected in such atlases, and the author's remarks thereon and the accompanying pictures are well worth study.

His last chapter, on the study of the functional efficiency of the kidney, is rather scanty and not, we consider, up to the level of the rest of the book; pyelography is omitted, and the remarks on the congenital abnormalities of the urinary tract are limited to the mention of the occurrence of duplication of the ureters.

We sincerely congratulate Dr. Otto Kneise on the production, and after studying it we are left in doubt whether most to admire his skill as an artist, his scientific attainments, or his wonderful capacity for hard work.

Intracranial Tumours and some Errors in their Diagnosis. By Sir JAMES PURVES-STEWART, K.C.M.G., C.B., M.D. (Edin.), F.R.C.P., Senior Physician to the Westminster Hospital, etc. Demy 8vo. Pp. 206 + xii, illustrated. 1927. London: Humphrey Milford. 12s. 6d. net.

THE author has produced a readable and practical volume based entirely upon his own personal experience of some 250 cases of intracranial tumour. The lessons which are to be learned from a study of this material are clearly demonstrated by admirably concise clinical notes and by well-selected illustrations. The chapter on errors in diagnosis is most valuable. The book contains but little direct reference to the surgery of the subject, but it should well repay careful study by all those who undertake the operative treatment of intracranial tumours.

Tropical Surgery and Surgical Pathology. By KARUNA K. CHATTERJI, F.R.C.S.I.; Major, I.T.F. Medical Corps; Surgeon, Medical College Hospitals, Calcutta. With a Foreword by Major-General SIR R. HAVELOCK CHARLES, G.C.V.O., K.C.S.I., M.D., etc. Demy 8vo. Pp. 244, with 91 plates, 20 in colour, and 5 charts. 1927. London: John Bale, Sons & Danielsson. 16s. net.

THIS is a book that will be of value chiefly to the surgeon who practises, and the student who learns, in the Tropics, but it can be recommended also for reference to the European surgeon, who finds little enough in the standard text-books on surgery to help him with the occasional instances of tropical surgery that cross his path.

The greater part of the volume is devoted to an exhaustive description of the various forms of amœbiasis and filariasis. The tropical granulomata also receive adequate treatment, but the sections on abdominal surgery in the Tropics and neoplasms in the Tropics are somewhat too sketchy to be satisfying. The author has surmounted the difficulty of writing a text-book in a foreign language with remarkable success, and the work is on the whole well arranged, though a tendency to redundant statements might with advantage be eliminated in a later edition. The book is profusely illustrated, and most of the illustrations are clear.

Recent Advances in Hæmatology. By A. PINEY, M.D., Ch.B. (Birm.), M.R.C.P. (Lond.), Research Pathologist, Cancer Hospital, London. Crown 8vo. Pp. 276 + viii, with 4 coloured plates and 18 text figures. (Recent Advances Series.) 1927. London: J. & A. Churchill. 12s. 6d. net.

THIS long-wanted book finds us eagerly expectant, but—perhaps because we hoped for so much more—leaves us very unsatisfied. The writer deliberately confines himself to blood cytology, thus rendering necessary another volume in which shall be collected the recent work on other aspects of hæmatology. Then, again, this volume differs from others in the series in that but little space is afforded to the practical aspects of the subject, and that the proportion of debatable theory is so high. A work of this kind should, we feel, be a collection of those recent advances which have met with a sufficiently wide acceptance by hæmatologists; and such subjects as the writer's own views on the reticulo-endothelial system, and the site of formation of megaloblasts, should find expression for the moment under some other cover.

We are inclined to agree with the writer in his renunciation of the oxydase reaction as not being positive in the earliest myeloblast; but the work of Price-Jones on the diameter of the red cells, and of Ledingham on platelets, might well be discussed fully. The coloured illustrations are exceedingly good—among the best we have ever seen—but we are not convinced that the writer's method of making blood films is the best, and we are very envious of the facility with which he appears able to distinguish myeloblasts from lymphoblasts.

Although we are not prepared to agree with the writer on quite a number of points, there is much in this book which makes it well worth reading. We feel, however, that it should have appeared under another guise, with a different title. A very good and helpful bibliography is appended.

Orthopædic Surgery. By W. A. COCHRANE, M.B., Ch.B., F.R.C.S.E., Assistant Surgeon, Royal Infirmary, Edinburgh, etc. Demy 8vo. Pp. 528 + xxiii, illustrated. 1926. Edinburgh: E. & S. Livingstone. 21s. net.

MR. COCHRANE in the first part of his book approaches the subject of orthopædic surgery from a standpoint that is new to this country. He is anxious "that the student should banish the idea that he is concerned only with an aggregation of local problems of deformity, important as they are, and will substitute a conception on the broad basis of anatomy with reference to the statics and mechanics of the body as a whole. It is only through these spectacles that disabilities of the locomotory apparatus of the body can be viewed intelligently and linked up with knowledge of pathology, medicine and surgery."

A lengthy consideration is given to the different human types, differentiated by their anatomical structure and postural habits, to the work of Goldthwait, Bean, and others, and to the liability of the different types to particular diseases. Further, there is a good description of the work of Sherrington and Hunter on muscle tone and the mechanism of the maintenance of posture, so that finally this side of orthopædics—the habitual posture of the patient and the activity of the body—is brought in as a factor in effecting prevention and cure in many branches of medicine and

surgery. It is perhaps unfortunate that the nomenclature that has been adopted in describing human types—for example, the "splanchoptotic, congenital viscero-ptotic, or carnivorous" type—makes reading of this subject somewhat difficult. This, together with the fact that all such work is in the early and not altogether scientific stage, is a little apt to make the general reader pass over the subject with the idea that there is really very little in it. It is, however, a side of medicine which will very well repay further study. Two examples of its importance may be quoted. Orthostatic albuminuria has been shown to occur in young people in whom a particular postural type is present, and such albuminuria has actually been brought on by artificially inducing a posture of lordosis. Rieser has suggested that in this position the left renal vein may be compressed in certain people. Codman considers that ulcers of the stomach and duodenum may be due to bad posture, and others have shown that a chronic duodenal ileus may arise from compression of the root of the mesentery, a possible result of defective posture.

The latter part of this section of the book is given up to physical education in relation to medicine. Goldthwait's system of exercises is described, and although this has no advantages over the Swedish system generally adopted in this country, it has the great merit of simplicity.

The second portion of the volume deals with orthopædic surgery on more ordinary lines; it is systematic and thorough. As an example, the section on deformities of the foot and ankle may be taken, where a description of the anatomy and function is followed by simple mechanical disabilities—a more important section than that on the severer deformities, because the disabilities are so very much more common. The commoner injuries in the shape of sprains and ordinary types of fractures are included, and all details of the author's own methods of treatment are described at sufficient length to enable them to be imitated, but without undue detail of operative procedures.

The book is very well and clearly illustrated, and is both suitable for the student and practitioner and useful for the orthopædic surgeon.

L'Angine de Poitrine et l'Angine abdominale. By D. DANIELOPOLU, Professor of Clinical Medicine in the Faculty of Medicine at Bucarest, etc. 4to. Pp. 443 + viii, with 159 illustrations (some in colour). 1927. Paris: Masson et Cie. Fr. 140.

THIS comprehensive work in French makes available the labours of Professor Danielopolu in the symptomatology, etiology, pathology, and treatment—especially surgical—of angina. It is a stupendous volume—complete, erudite, and exhaustive—and the argument is unfolded in epic fashion. The notions in it are well known by the author's former publications, but this book represents his *magnum opus* and finished views. As a physician the Professor would not have had the full approval of Allbutt or of Mackenzie for this volume, nor is Wenckebach in full concord; and the purely clinical side of the surgical treatment has already been rather unkindly criticized in England by Lewis. But as a physiologist and clinical pathologist directing a surgical technique the Professor is a pioneer, and his erudition places him far out of the reach of criticism.

There are two notable contributions to the science of medicine. The first is an emphatic insistence on the unity of the basic pathology in the various syndromes known to English readers as angina pectoris, false angina, pseudo-angina, and abdominal angina. This basic pathology is held to be an ischæmia of contractile tissue brought about as a rule by an obstructive arterial lesion, and the consequent accumulation of toxic products in the tissue with harmful stimulation of sensory nerve-endings. Pure and organic angina is mainly expounded in the book, and the sensory nerve-endings in the heart muscle, their path in the cardio-aortic nerves, and the places where they are vulnerable to surgical treatment are clearly charted. The second contribution is a consideration of the 'pressor reflex' conveyed in these nerves. Along with a description of the pressor reflex there is naturally an account of the anatomy and pathology of the nerves concerned in the agony. These latter

nerves are happily closely related anatomically with the nerves bearing the pressor reflex. In essence Danielopolu's conception of angina pectoris is :—

1. For some reason a disturbance of balance between the work of the heart and its vascular nutrition occurs—whence
2. Toxic bodies accumulate in the heart muscle, and these
3. Stimulate the endings of the cardio-aortic nerves. By this
4. Two groups of reflexes are launched. The one is the pressor reflex by which the blood-pressure is heightened and the force of the heart-beat augmented, thus setting up a vicious circle in a heart already burdened. The second is a discharge of sensibility along associated nerves, whereby the anguish and agony of the anginal attack are represented and brought into consciousness in the clinical syndrome so well known.
5. Both these nerve-paths can be interrupted by section of the *cervical sympathetic*; section of *certain fibres of the cervical vagus*; section of the *intrathoracic branches of the cervical vagus*; section of the *vertebral nerve*; section of *communicating branches* uniting the inferior cervical ganglion and 1st thoracic nerves with the 6th, 7th, and 8th cervical nerves and 1st dorsal nerves.

To English and American readers—of whom there will be many—it will appear strange that such a book should be so ill-bound and that it should contain so many literal errors, especially in the large bibliography. The chapter on etiology is intensely disappointing, and is indeed little more than a blank '*ignoramus*'. Many of the diagrams take hours to unravel, but the complexity of the subject is responsible for this. The photographs are magnificent. The whole volume is fairly easy to read if one puts one's elbows on the table: not otherwise.

This great work is certain to have an immense vogue in Western Europe and America, but the classical views of Allbutt and Mackenzie, the *tour de force* whereby Wenckebach addressed the Royal College of Physicians of London in 1924, the writings of Leriche, the work of Coffey and Brown in America, and the researches of Langley and Jonnesco, must be consulted by those who embark on the procedures advocated.